EXPANDED SITE INSPECTION
TASK WORK PLAN

DELTA SHIPYARD
HOUMA, TERREBONNE PARISH, LOUISIANA
EPA CERCLA ID NO. LAD058475419

Prepared for:

U.S. Environmental Protection Agency
Region VI
1445 Ross Avenue
Dallas, Texas 75202

Contract No.: 68-W9-0015
Work Assignment No.: 26-6JZZ
Document Control No.: 04603-026-0060

Prepared by:

Roy F. Weston, Inc.
Houston, Texas

July 1996

2 temp wells added w/ several SED samples ADDED work will be reflected in final report

EXPANDED SITE INSPECTION
TASK WORK PLAN

DELTA SHIPYARD
HOUMA, TERREBONNE PARISH, LOUISIANA
EPA CERCLA ID NO. LAD058475419

JULY 1996

SIGNATURE PAGE

Lon Biasco
U.S. Environmental Protection Agency
Work Assignment Manager

Date

for John D. DiFilippo, P.E.
Roy F. Weston, Inc.
Zone Program Manager

7/1/96
Date

for Robert B. Beck, P.E.
Roy F. Weston, Inc.
Site Manager

7/1/96
Date

Cecilia H. Shappee, P.E.
Roy F. Weston, Inc.
Quality Assurance Officer

7/1/96
Date

Eric C. Tate
Roy F. Weston, Inc.
Project Team Leader

Date

EXPANDED SITE INSPECTION
TASK WORK PLAN

DELTA SHIPYARD
HOUMA, TERREBONNE PARISH, LOUISIANA
EPA CERCLA ID NO. LAD058475419

TABLE OF CONTENTS

SITE INSPECTION
TASK WORK PLAN

DELTA SHIPYARD
HOUMA, TERREBONNE PARISH, LOUISIANA
EPA CERCLA ID NO. LAD058475419

TABLE OF CONTENTS
(continued)

EXPANDED SITE INSPECTION
TASK WORK PLAN

DELTA SHIPYARD
HOUMA, TERREBONNE PARISH, LOUISIANA
EPA CERCLA ID NO. LAD058475419

LIST OF FIGURES

EXPANDED SITE INSPECTION
TASK WORK PLAN

DELTA SHIPYARD
HOUMA, TERREBONNE PARISH, LOUISIANA
EPA CERCLA ID NO. LAD058475419

LIST OF TABLES

EXPANDED SITE INSPECTION
TASK WORK PLAN

DELTA SHIPYARD
HOUMA, TERREBONNE PARISH, LOUISIANA
EPA CERCLA ID NO. LAD058475419

LIST OF APPENDICES

APPENDIX	DESCRIPTION
A	Site Access Agreement
B	Health and Safety Plan
C	Sampling Procedures
D	CLP Guidelines

SECTION 1
INTRODUCTION

Under the authority of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and the 1986 Superfund Amendments and Reauthorization Act (SARA), Roy F. Weston, Inc. (WESTON®) has been contracted by the U.S. Environmental Protection Agency (EPA) to perform an Expanded Site Inspection (ESI) of the Delta Shipyard site (EPA Identification No. LAD058475419) located in the city of Houma, Terrebonne Parish, Louisiana (Figure 1-1). Based on available site information, WESTON believes that the site is eligible for action under CERCLA/SARA. EPA Region 6 retained WESTON to complete this investigation under EPA Contract No. 68-W9-0015 and Work Assignment No. 26-6JZZ.

WESTON has prepared this Work Plan to describe the activities that will be completed as part of the Delta Shipyard ESI. A summary of the site history and known waste characteristics, previous site investigations, and the ESI sampling activities are provided in this Work Plan. WESTON will follow EPA's Contract Laboratory Program (CLP) and WESTON's Corporate Quality Assurance/Quality Control (QA/QC) guidelines for sample collection, chain-of-custody transfer, and analytical data management during the performance of the Delta Shipyard ESI.

1.1 PURPOSE AND OBJECTIVE OF THE ESI

The ESI is intended to be the final investigation in an ongoing screening process of known and potential hazardous waste sites. The purpose of this ESI is to identify immediate or potential threats that hazardous substances attributable to the site may pose to human health and the environment by documenting the existence and migration of hazardous substances related to the site and by identifying the receptors, or targets, potentially exposed to the hazardous substances. EPA will use the information obtained during the ESI to evaluate the site using the Hazard Ranking System (HRS) and to help decide if the site is a potential candidate for inclusion on the National Priorities List (NPL). The intent of the ESI is to provide the documentation necessary to either rank a site on the NPL or assign a "No Further Remedial Action Planned" (NFRAP) status.

1.2 SCOPE OF WORK

The objective of this ESI is to further define the extent and characteristics of hazardous waste at the site through the collection and analyses of waste, sediment, and surface water samples from locations on and around the Delta Shipyard site. The specific activities that will be performed during the ESI to achieve the objective have been divided into major tasks, as follows:

- Obtain and review available background information concerning the site.
- Research data related to the groundwater, surface water, soil exposure, and air pathways.

- Conduct a site reconnaissance to document current site conditions, locate hazardous waste sources, identify potential receptors or targets of a release, and select sample locations.

- Prepare a site-specific Task Work Plan and HASP describing site reconnaissance activities and appropriate safety protocol.

- Collect and analyze waste, sediment, and surface water samples to document and characterize on-site hazardous waste sources and the extent of off-site contaminant migration.

- Prepare an ESI report to document the results of the site reconnaissance, sampling activities, and sample analyses, as well as to present the background information obtained for the site.

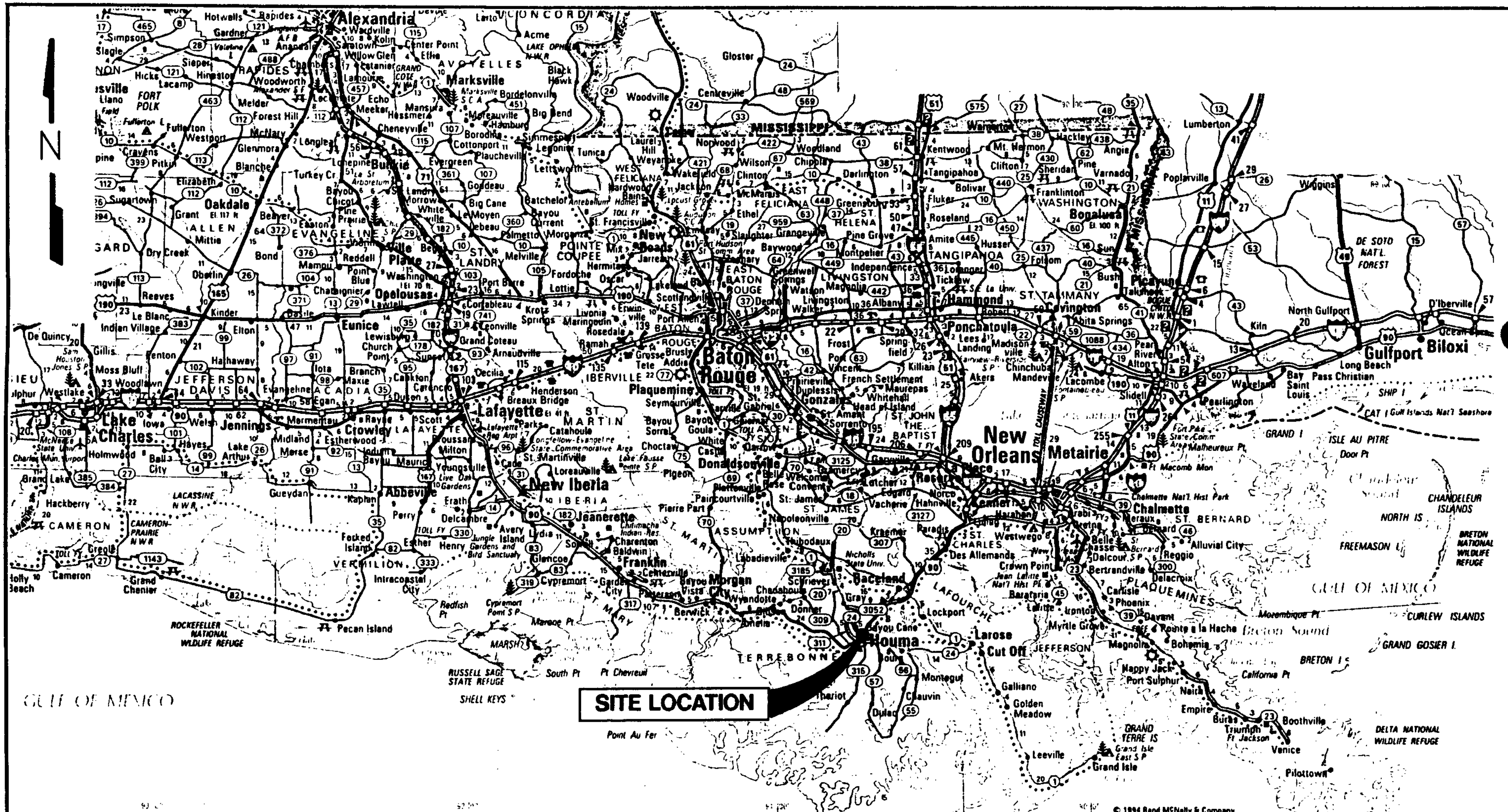
The project tasks are based on WESTON's understanding of the site background information and the generic scope of the ESI Work Assignment. These will be discussed in greater detail in the following sections.

1.3 WORK PLAN FORMAT

The ESI Work Plan has been organized in the following format:

- Section 1—Introduction
- Section 2—Site Background Information
- Section 3—Exposure and Migration Pathway Characteristics
- Section 4—Sampling Activities
- Section 5—Project Information
- Section 6—Reference List

A copy of the site access agreement is provided in Appendix A, the site-specific HASP is provided in Appendix B, sampling procedures are provided in Appendix C, and CLP guidelines are provided in Appendix D. The tables and figures referenced throughout this work plan are provided following the text of each section.



MAP PREPARED FROM
RAND McNALLY ROAD ATLAS
LOUISIANA
1990 EDITION

0 15 30
APPROXIMATE SCALE IN MILES

WESTON
MANAGERS DESIGNERS/CONSULTANTS

FIGURE 1-1
SITE LOCATION MAP

DELTA SHIPYARD
HOUMA, LOUISIANA

CERCLA ID. NO. : LAD058475419

EPA REGION VI
ARCS EXPANDED SITE INSPECTION

W.O. NO. : 04603-026-031-0100

SECTION 2
SITE BACKGROUND INFORMATION

A summary of the location, description, operational history, source characteristics, and other concerns at the site is presented in this section. The site background information has been acquired from reports previously completed for the site, as well as from WESTON's site reconnaissance.

2.1 SITE LOCATION

The Delta Shipyard site is located on the south side of the City of Houma, Terrebonne Parish, Louisiana. The geographic coordinates of the site are approximately 29°34'09" north latitude and 90°42'17" west longitude (WESTON, 1996). A Site Area Map derived from a U.S. Geological Survey (USGS) 7.5-minute topographic map is provided as Figure 2-1 (USGS, 1963).

The site can be reached by traveling south on U.S. Highway 90 from New Orleans to Houma. Turn left (east) on Main Street and travel approximately 1.8 miles to Howard Avenue. Turn right (south) on Howard Avenue and travel approximately 2.2 miles to Industrial Boulevard. Turn left (east) on Industrial Boulevard. The site is located at 202 Industrial Boulevard, approximately 0.5 mile east of Howard Avenue.

The site is currently owned by Mr. Lynn Dean and occupied by several industries including Elevated Boats, Inc (EBI). WESTON contacted Mr. Dean (8404 Colonel Drive, Shelmett, Louisiana 70043) in January 1996. Mr. Ken Serigne, Plant Manager for EBI ([504] 868-9655), signed an EPA Access Agreement form on 13 February 1996 allowing WESTON access to the site (Appendix A). WESTON met with Mr. Serigne during the site reconnaissance (Tate, 1996).

2.2 SITE HISTORY

The early details of site history are sketchy but indicate that the site was owned by Delta Ironworks. The site was part of a large industrial park covering 165 acres and home to seven divisions of Delta Ironworks, including Delta Shipyard. Available information indicates that Delta Shipyard was the only division that handled hazardous wastes. In 1969, Delta Ironwoods was sold to the Chromalloy American Corporation of St. Louis, Missouri. Chromalloy maintained all seven divisions until November 1980 when five of them (including Delta Shipyard) were sold to Delta Services Industries of Houma. Mr. Dean purchased 110 acres of the industrial park in 1986 including the property used by Delta Shipyard.

Delta Shipyard consisted of a cleaning and repairing facility for small cargo boats, fishing boats, and oil barges. Before repair work could begin, the boats had to be certified vapor free by the U.S. Coast Guard. In order to accomplish this, the boats were first steam cleaned to remove oily wastes. The generated oils and wastewater were subsequently sent through a separation process after which the waste oil was recovered and sold. Wastes were stored in two unlined pits used as evaporation ponds. The pits were later closed and backfilled in 1984 under the

supervision of the Louisiana Department of Environment Quality (LDEQ) Hazardous Waste Division. The area is currently covered with gravel and used as a parking lot for EBI employees.

2.3 SITE DESCRIPTION

WESTON completed the ESI site reconnaissance on 7 March 1996. The site is located in a large industrial park which covers approximately 165 acres in southeastern Houma. The industrial park forms a peninsula bordered by Bayou La Carpe to the west, boat slips to the east, and Industrial Boulevard to the north. Bayou La Carpe provides access to the Gulf of Mexico by the Intracoastal Waterway and the Houma Navigation Canal. Mr. Dean currently owns 110 acres of the industrial park, which is occupied by EBI and several other industries including Gemoco to the north; Montco (Christie Industries), Salvage Association, and Huber to the South; Offshore Diving, LaForce Enterprise, and Tomahawk to the southwest; and Robichaux Equipment and Sigma Welders to the northwest. A Site Plan is provided as Figure 2-2.

EBI maintains a fabrication plant/office building on-site. Current site operations consist of the fabrication and operation of offshore lift boats and the manufacture of cranes for offshore platforms. The site contains some former gas stripping equipment (storage tanks, separator, boiler) remaining from the Delta Shipyard operation. The backfilled waste oil pits are currently used as an employee parking lot, and are located approximately 100 feet east of the fabrication building. Two monitoring wells are reportedly located at the edge of the parking lot, but only one could be located during WESTON's site reconnaissance.

Four larger unlined pits are located approximately 800 feet south of the fabrication building (Pits 1 through 4 on Figure 2-2). The pits were reportedly used to dispose of waste oil and oil field drilling material (The Earth Technology Corporation, 1984). Pits 1 through 3 are located east of Plant Shell Road and contain a black oily sludge material to an unknown depth. A drainage ditch trends south along the western edge of the pits before turning east along the southern edge of Pit 3 and discharging to Bayou La Carpe. A berm surrounds pits 1 through 3, but an overflow pipe in Pit 2 allows runoff from the pits to flow into the drainage ditch. Pit 4 is located west of Plant Shell Road and has apparently been backfilled and currently appears as a grassy field.

2.4 SUMMARY OF PREVIOUS INVESTIGATIONS

WESTON reviewed available EPA and LDEQ files to collect information regarding previous investigations completed at the Delta Shipyard. This information is summarized in the following paragraphs.

- On 3 to 4 November 1980, Soil Testing Engineers, Inc. completed two 50-foot soil borings adjacent to the two closed pits located near the EBI office building. Soil samples were collected from the borings and submitted to a geotechnical laboratory for analyses. The results revealed the presence of clay throughout the boring interval. The clay in the 0-to-15 foot range was found to have permeabilities ranging from 10^{-7} centimeters per second (cm/sec) to 10^{-8} cm/sec.

Two monitoring wells were installed near the borings, to depths of 13 and 20 feet below ground surface (Dave, 1980).

- On 11 March 1981, Ecology and Environment, Inc. completed an EPA Preliminary Assessment. The report detailed available site history and indicated that the site received five hundred 55-gallon drums per year containing oily wastes and that waste manifests were maintained on-site (Ecology and Environment, Inc., 1981).

- On 12 September 1984, The Earth Technology Corporation completed an EPA Site Inspection. The report summarized the closure of the two waste oil pits in early 1984. According to the report, the pits were first drained and samples of the oil sludge remaining in the bottom were collected. The sludge samples were then analyzed for corrosivity, toxicity, ignitability, and reactivity. Following LDEQ review of the sample results, the remaining sludge was reportedly mixed with 30 cubic yards of sandy soil prior to backfilling. Following the pit closures, an aboveground storage tank (AST) was installed to replace the pits in the oil-water separation process (The Earth Technology Corporation, 1984).

- In June 1985, Wink Engineering collected sludge samples from pits 1 through 4. The report indicated that pits 1 through 3 were exposed and impoundment 4 was covered with a thin crust of fill material. The samples were analyzed for volatile organic aromatics, cyanide, total phenol, flash point, pH, toxicity, and oil & grease. Based on the results, the report concluded that the site did not pose a threat to human health or the environment (Dussel, 1985).

- WESTON completed a Site Inspection Prioritization (SIP) report in December 1994. A limited number of sludge and drainage ditch sediment samples were collected in and around pits 1 through 4 during the investigation. The analytical results revealed the presence of several semivolatile organic compounds (WESTON, 1994).

2.5 SOURCE CHARACTERISTICS AND SITE CONCERNS

The following subsections describe information concerning the known or potential sources at the site and the constituents thought to be associated with each source, along with a summary of potential concerns associated with contaminant migration and exposure.

2.5.1 Source Characteristics

Based on available background information, the potential sources identified at the site include six pits and an AST. The two closed pits each measured 75 feet by 35 feet by 5 feet in depth, are currently backfilled and covered with gravel, and are used as an employee parking lot. The AST has a capacity of 22,800 gallons and contains an unknown quantity of waste oil sludge, reportedly from historical Delta Shipyard activities. The AST is adjacent to the closed pits and

is encompassed by a 1-foot berm. Data detailing the chemical components of the closed impoundments and AST are not available.

Based on the observations during WESTON's site reconnaissance, pits 1 through 4 warrant the most attention. Samples from the upper 2 feet of pits 1 through 4 and the associated drainage ditch were collected during the 1994 SIP. The analytical results of the pit samples indicated the presence of the following constituents:

- 2-methylnaphthalene, [47 milligrams per kilogram (mg/kg)]
- Fluorene (5.1 mg/kg)
- Naphthalene (11.0 mg/kg)
- Phenanthrene (8.8 mg/kg)
- Barium (18,000 mg/kg)

It should be noted that the samples collected from the pits were not composed of sludge present in the pits, but rather were collected from soil of the pit berms. This allowed the samples to be analyzed through the CLP. It is anticipated that the sludge in the pits contains higher concentrations of contaminants. Analyses of the drainage ditch sediment samples showed the following:

- Benzo(a)anthracene (6.0 mg/kg)
- Benzo(a)pyrene (4.1 mg/kg)
- Benzo(b)fluoranthene (6.1 mg/kg)
- Chrysene (5.3 mg/kg)
- Fluoranthene (13.0 mg/kg)
- Phenanthrene (5.0 mg/kg)
- Pyrene (12.0 mg/kg)
- Barium (20,500 mg/kg)

2.5.2 Site Concerns

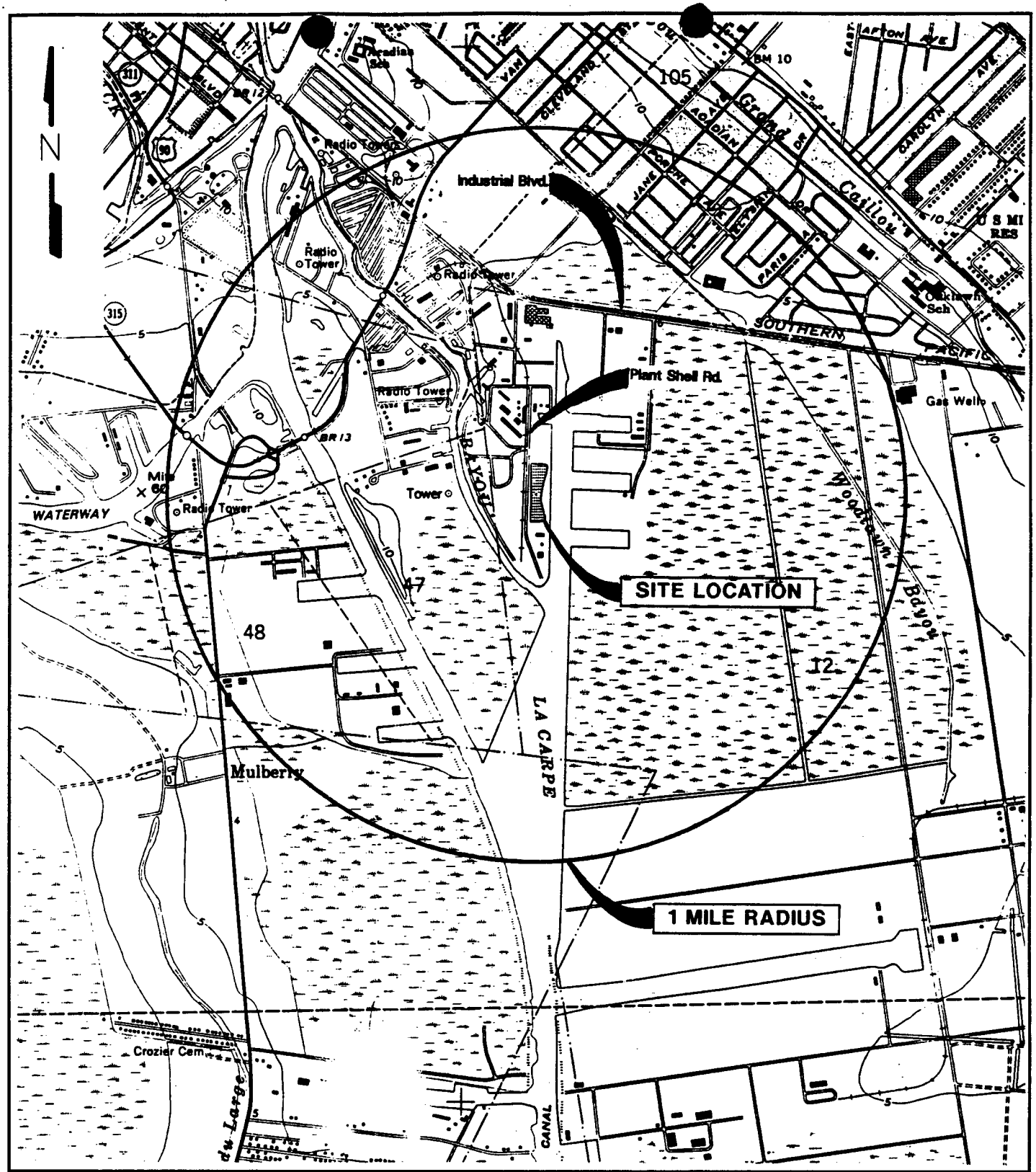
Possible concerns associated with the sources at the site and the migration of or exposure to hazardous substances attributable to the site through the groundwater, surface water, soil exposure, and air pathways include the following:

- The waste oil pits at the site are unlined, and as such, it is likely that a release to groundwater has occurred. However, due to the low permeability of subsurface soils and the lack of groundwater use in the site vicinity, the groundwater pathway appears to be of minor concern.

- Based on the appearance of related hazardous constituents in pits 1 through 3 and the associated drainage ditch, the surface water pathway is of major concern at the site. The drainage ditch discharges to the perennial-flowing Bayou La Carpe approximately 50 feet southeast of pit 3. Drinking water intakes, fisheries, and sensitive environments are each located in the surface water pathway for the site.

- A release to surface soil has been documented in the 1994 SIP report. However, the site is located in an industrial area and the pits are not frequented by workers. As such, the soil exposure pathway appears to be of minor concern.

- A release to air is of minor concern based on the results of historical field air monitoring and the low population density in the immediate site vicinity.



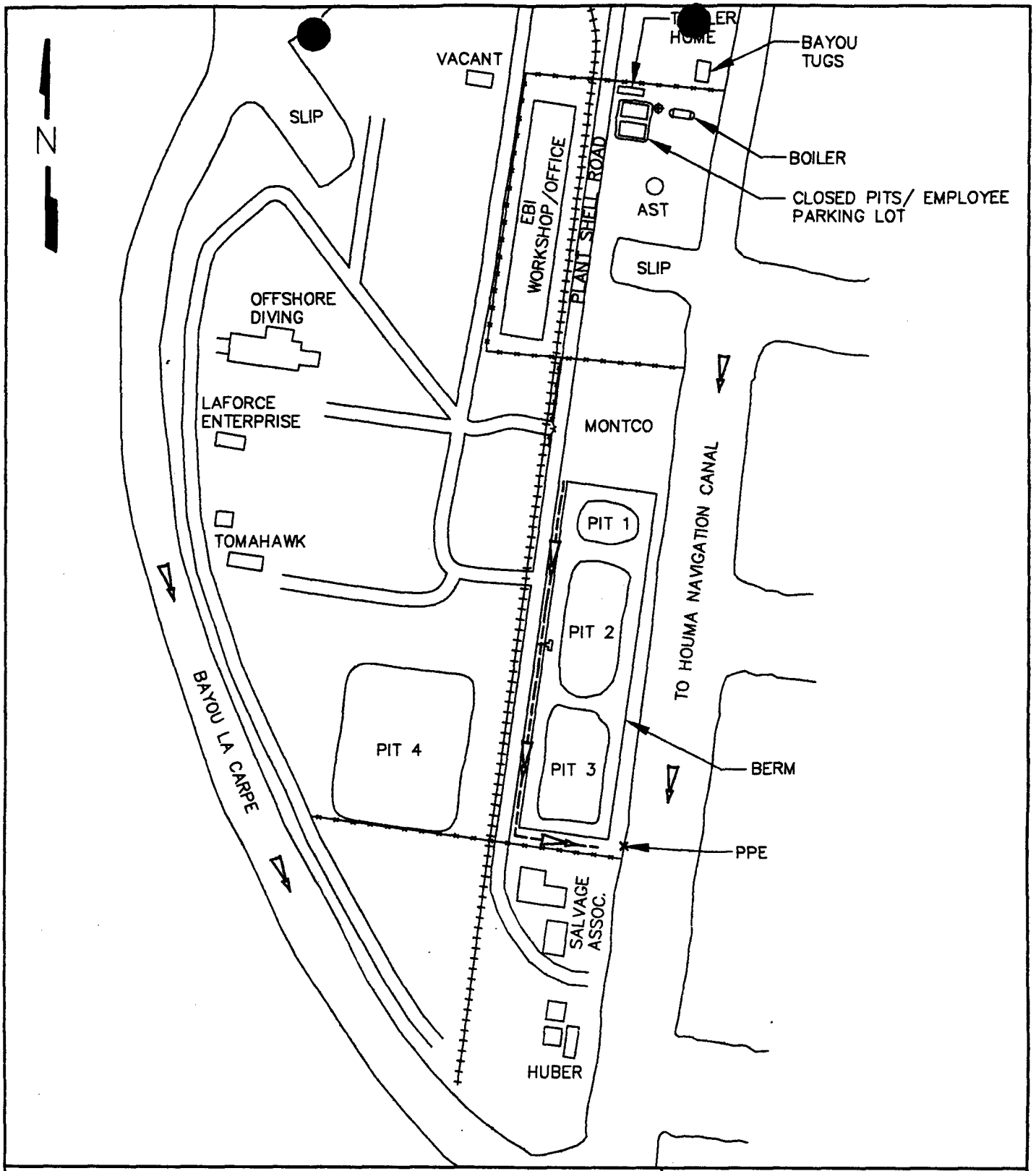
BASE MAP FROM:
U.S. DEPT. OF THE INTERIOR
GEOLOGICAL SURVEY
HOUMA QUADRANGLE
LOUISIANA
7.5 MINUTE SERIES (TOPOGRAPHIC)
1963 SERIES

0 1000 2000
SCALE IN FEET

WESTON
MANAGERS DESIGNERS/CONSULTANTS

FIGURE 2-1

SITE AREA MAP
DELTA SHIPYARD
HOUMA, LOUISIANA
CERCLA ID. NO. : LAD058475419
EPA REGION VI
ARCS EXPANDED SITE INSPECTION
W.O. NO. : 04603-026-031-0300



LEGEND:

- OVERFLOW PIPE
- FENCE
- FLOW DIRECTION
- DRAINAGE DITCH
- MONITORING WELL

0 200 400

SCALE IN FEET

WESTON MANAGERS DESIGNERS/CONSULTANTS

FIGURE 2-2

SITE PLAN

DELTA SHIPYARD
HOUMA, LOUISIANA

CERCLA ID. NO. : LAD058475419

EPA REGION VI
ARCS EXPANDED SITE INSPECTION

W.O. NO. : 04603-026-031-0300

H:\ARCS\ARC2631\0300C.PA.JC 1=1 06-25-96 (PCP=ARCS)

SECTION 3
EXPOSURE AND MIGRATION PATHWAY CHARACTERISTICS

Information regarding the groundwater, surface water, soil exposure, and air pathways is presented in the following subsections. Sampling and nonsampling data collected to date are addressed. Known data gaps are identified at the end of the section.

3.1 GROUNDWATER PATHWAY

The site is situated on Quaternary-age terrace and alluvial deposits composed primarily of silty clays. Borings logs completed during the November 1980 subsurface investigation show the presence of clay from the surface to a depth of 50 feet. Laboratory consolidation tests indicate the permeability of the upper 15 feet to be between 10^{-7} and 10^{-8} cm/sec. Two shallow monitoring wells were also completed during the 1980 investigation, but sample data from the wells are not available. However, water well information obtained from the Louisiana Department of Transportation and Development indicates that there are no drinking water wells within 1 mile of the site (LDOTD, 1996).

3.2 SURFACE WATER PATHWAY

The Delta Shipyard site is located near the confluence of several sizable streams, including Bayou La Carpe, the Houma Navigational Canal, the Intracoastal Waterway, and Bayou Black. Each of the streams receive frequent barge traffic from area industries. See Figure 3-1 for a schematic of the surface water bodies in the site vicinity.

Surface runoff from pits 1 through 3 flows south in a drainage ditch that runs along the west side of the pits. After approximately 1,000 feet, the ditch discharges to Bayou La Carpe, the probable point of entry to the surface water pathway. Bayou La Carpe flows south approximately 4,000 feet to the confluence with the Houma Navigational Canal, which eventually discharges to the Gulf of Mexico. Surface water flow in all water bodies in the Houma area is generally to the south; however, Bayou La Carpe, the Houma Navigational Canal, and the Intracoastal Waterway are tidally influenced, which at times causes considerable northward flow. As a result, targets both downstream and upstream of the site are potentially impacted by the site.

The Houma Water Plant (shown on Figure 3-1 as Water Plant No. 3) is located along the Intracoastal Waterway, approximately 2.5 miles upstream of the site. The Intracoastal Waterway is the main water source, but during times when advancing tides and associated brackish water reach the plant, intakes along nearby Bayou Black are used. Documentation of the northernmost point of saltwater intrusion is not available. However, for the purpose of this ESI, the intakes along Bayou Black will serve as that point. The Houma Water Plant supplies potable water to approximately 33,000 residents of Houma and the nearby towns of Dulac and Dularge (Ishigo, 1996a).

Bayou La Carpe, the Intracoastal Waterway, and the Houma Navigational Canal are used as commercial fisheries near the site. Catfish and bass are generally caught in freshwater areas. When the tides bring brackish water, redfish become the main catch. The majority of area commercial fishing occurs farther south in the Houma Navigational Canal, but a local fishery specialist has estimated an annual catch within 5 miles of Houma at or below 1,000 pounds; further south the annual total increases to approximately 10,000 pounds (Ishigo, 1996b).

Based on available National Wetlands Inventory Maps, the Houma Navigational Canal is extensively bordered by wetlands (U.S. Fish and Wildlife Service, 1991 and 1992). Several federally threatened and endangered species are known to exist in Terrebonne Parish and include the piping plover, bald eagle, and brown pelican. However, based on available information, none of the species have been documented within the surface water pathway for the site (Rettig, 1996).

3.3 SOIL EXPOSURE

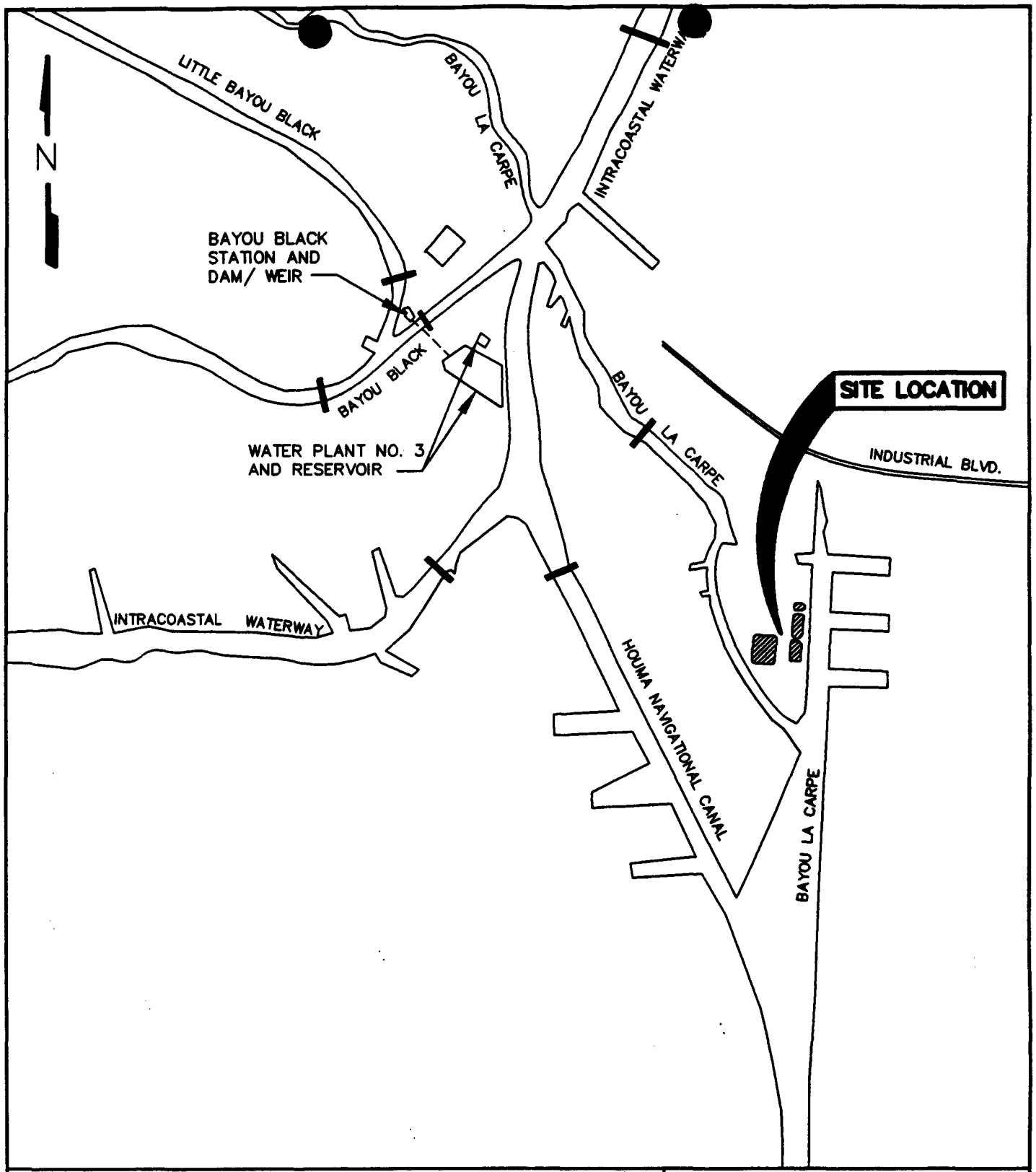
Of the six pits and one AST at the site, only pits 1 through 3 have documented hazardous contamination within 2 feet below the ground surface. Public access to the pits is not restricted, but the site and surrounding properties have no apparent recreational value. In addition, the pits are surrounded by fairly dense vegetation. Land use in the site vicinity is primarily industrial and EBI maintains approximately 30 workers on-site. There is a trailer on-site immediately north of the employee parking lot (closed pits) that is home to two friends of Mr. Dean; however, there is no documented surficial contamination within 200 feet of the trailer.

3.4 AIR PATHWAY

The air pathway appears to be of minor concern based on the results of field air monitoring during the ESI site reconnaissance. In addition, there have reportedly been no disposal activities at the site for at least 10 years. However, field monitoring for organic vapors during the 1994 SIP resulted in the detection of organic vapor concentrations in excess of 1,000 times greater than background readings at the surface-air interface of pits 1 through 3. Organic vapor levels in breathing zone were measured at 1 to 3 times greater than background.

3.5 DATA GAPS

Based on review of the background information available and observations made during the site reconnaissance, analytical data are needed from pits 1 through 3 for waste characterization and from the surface water pathway to determine the extent of off-site contaminant migration.



LEGEND:

BRIDGE

0 1000 2000

SCALE IN FEET

WESTON
MANAGERS DESIGNERS/CONSULTANTS

FIGURE 3-1

STREAM LOCATION MAP

DELTA SHIPYARD
HOUMA, LOUISIANA
CERCLA ID. NO. : LAD058475419

EPA REGION VI
ARCS EXPANDED SITE INSPECTION

W.O. NO. : 04603-026-031-0300

H:\ARCS\ARC2631\0300C.PA.JC 1=1 06-24-96 (PCP=ARCS)

SECTION 4
SAMPLING ACTIVITIES

The activities planned for the ESI sampling visit are outlined in this section of the work plan. The sampling strategy presented is based on the operational history, known source waste characteristics, probable pathways of contaminant migration, and likely targets related to the site. The ESI field activities will focus on both on- and off-site sampling to document and characterize hazardous waste sources at the site and to identify observed contamination or releases.

WESTON will complete waste, sediment, and surface water sampling activities as part of the ESI. Samples will be collected using sampling techniques and QC procedures that meet EPA Region 6, EPA CLP, and WESTON guidelines. The specific tasks that will be performed during the sampling visit are described in Subsections 4.2, 4.3, and 4.4. It is expected that the tasks will be completed in the order outlined in these subsections. However, some tasks may overlap with others. General information for each task is provided as instructions to guide the field team.

It is important to note that the intent of the sampling mission is to sample what appear to be the most contaminated materials in the areas targeted for sampling. Based on the results of the site reconnaissance, WESTON has selected locations for sampling that appear to be those most likely to provide positive evidence of the presence of hazardous substances on- and off-site.

4.1 FIELD PERSONNEL

WESTON plans to have a field team of three people to complete the tasks described in the following subsections. The anticipated personnel, along with their respective project roles and responsibilities, are identified in Table 4-1.

4.2 MOBILIZATION TASKS

The tasks that the WESTON field team will complete prior to sampling are described in this subsection.

4.2.1 Task 1—Mobilization

The WESTON field team will mobilize from the WESTON Regional Equipment Stores (RES) warehouse in Houston, Texas. One or two team members will load equipment for the sampling visit in a van, quality-checking the equipment in the process. An equipment checklist will be used to verify that the necessary sampling equipment is included in the mobilization.

As part of the mobilization effort, the field team will assemble the required sample containers and CLP documentation prior to leaving for the site, as time permits. The sample tags, sample numbers, and custody seals needed for each sample station will be placed in a plastic lock-top bag. The sample station number will be labeled in ink on each bag. This process will facilitate sampling efforts once the fieldwork begins. When the required sampling equipment has been

loaded, one or two field team members will drive the equipment van to the site on the day before sampling activities are scheduled to begin. The remaining field team member(s) may drive or fly to the site. The field team generally will meet at its place of lodging, if any, before proceeding to the site. WESTON will inform the EPA Work Assignment Manager (WAM) of the sampling mission and its final schedule 2 weeks before the start date of the fieldwork.

Once at the site, the field team leader will meet with the site and EPA representatives, if present. The access agreement should be shown to the site representative to reconfirm site access. A copy of the Consent for Access form signed by the site representative is included as Appendix A.

As part of initial mobilization reconnaissance activities before going on-site, the WESTON team will drive the route from the site to the nearest hospital.

4.2.2 Task 2—Health and Safety Meeting and Protocol

After arriving at the site and checking in with the site representative, if present, the WESTON field team leader and the Site Health and Safety Coordinator (SHSC) will conduct a meeting to review the technical aspects of the project and discuss the site-specific HASP and related WESTON Standard Operating Procedures (SOPs) with the sampling team. The HASP and related SOPs are provided in this work plan as Appendix B. After this meeting, a copy of the HASP, with the map to the hospital on the first page, will be placed on the dashboard of the field vehicle designated for emergency use.

The fieldwork will be conducted in accordance with the site-specific HASP. The sampling team generally will work with Level-D personal protective clothing and equipment as specified in the HASP, as long as air-monitoring results justify this level of protection. The monitoring instruments to be used are specified in the HASP. A designated team member will perform a field calibration check and overall inspection of the monitoring instruments each day prior to sampling. Depending on the air monitoring results, the sampling team may be required to upgrade to a Level-C personal protection status if one or more of the air-monitoring action levels listed in the HASP are met or exceeded.

At the start of each day and as necessary at other times during the sampling visit, the field team leader will conduct safety meetings to reiterate site concerns and address any new technical or safety issues. For stream sediment sampling, WESTON will use a moderate size boat to traverse the streams and travel between sampling locations. The field team leader will be responsible for ensuring that boating safety protocols are adhered to and that sampling activities are terminated in the event of bad or deteriorating weather conditions.

4.2.3 Task 3—Initial Sample Location Reconnaissance

After the safety meeting is conducted, the WESTON field team leader will meet with the site representative and any EPA representative present to complete an initial survey of the sample locations indicated in the work plan. This will be done to allow the field team leader to become familiar with the area of investigation, verify that sample locations are accessible, and identify

potential health and safety concerns at each location. This initial reconnaissance will be conducted from the support zone as much as possible. If entry into a potential exclusion zone is required for this task, a second WESTON team member will accompany the field team leader to perform air monitoring during the reconnaissance.

If a sample location is found to be inaccessible for some reason, alternative sample locations may be chosen in consultation with the WESTON Project Team Leader (PTL). The PTL will communicate alterations in the work plan to the WESTON Site Manager and EPA WAM.

4.2.4 Task 4—Acquisition of Off-Site Access

Prior to performing sampling activities, the owners of any off-site properties for which sampling has been proposed will be contacted. Unless and EPA representative designated by the WAM to obtain off-site access is present in the field, the WESTON PTL will obtain permission from the owners for WESTON to collect samples from their property. The owners of off-site properties targeted for sampling will be provided with a fact sheet explaining the investigation, if one is available.

4.2.5 Task 5—Command Post Establishment

After the safety meeting has been held, the WESTON team will establish a command post in an accessible location at the site in an area generally thought to be unaffected by site operations, if such an area is available. The command post will be located in the support zone in which work may proceed in Level D without continuous air monitoring. Access to the exclusion zone and contaminant reduction zone established around the on-site waste sources will be controlled through the command post.

The command post will include the following:

- An equipment staging area where equipment can be prepared for use.
- A decontamination area (as specified in the HASP, Appendix B) where field personnel and equipment can be decontaminated.
- A sample management area where samples can be labeled, preserved, and packaged.

Sampling activities to be performed in off-site areas, if any, will mobilize from the on-site command post.

4.3 SAMPLING TASKS

Field tasks 6 through 12 associated with the collection of samples are described in the following subsections. Sample locations are shown in Figures 4-1 and 4-2 at the end of this section.

4.3.1 Task 6—Documentation of Field Activities

The WESTON field team leader will document in a logbook the activities performed during the sampling visit, as well as other significant observations made throughout the field investigation. The field team leader will keep a chronological log of field activities in the logbook. In addition, the field team leader will take photographs to support the observations documented in the logbook.

The documentation recorded in the logbook for each sample location will include the following:

- Sample station number.
- Sample location (including the depth and the distance and bearing from a fixed reference point).
- Sample description (matrix, color, odor, OVA responses, etc.).
- CLP sample numbers and tag numbers.
- Date and time of sample collection.
- Conditions around the sample location.

4.3.2 Task 7—Equipment Decontamination

Prior to sampling, the WESTON field team will decontaminate the sampling equipment that will come in contact with the samples during collection procedures. Equipment decontamination will be performed at the command post. To complete the decontamination process, the following steps will be taken:

- Wash equipment in a tub or bucket with a mixture of potable water and Liquinox (or other nonphosphate detergent).
- Rinse in a bucket with potable water.
- Rinse with deionized water.
- Allow to air dry.

To minimize the need for decontamination, WESTON will use dedicated sampling equipment, when available, for each sample station. WESTON will decontaminate the sampling equipment at the command post before and after use. The amount of rinsate water generated will be kept to a minimum, and the rinsate water generated during the decontamination processes will be collected in a small drum or 5-gallon buckets.

At the end of the field activities, the water will be disposed of at the end of the sampling mission in accordance with Task 17, discussed later in this work plan.

4.3.3 Task 8—Waste Sampling

WESTON will collect waste source samples at six sample stations (P01 through P06) during the field investigation to characterize pits 1 through 3. The waste samples will be collected from the 2-to-24 inch depth interval using a hand core sediment sampler. The waste samples will be collected in general accordance with the waste sampling operating procedures provided in Appendix C. The waste samples that WESTON will collect are summarized in Tables 4-2 and 4-3 and shown on Figure 4-1.

4.3.4 Task 9—Soil Sampling

WESTON will not collect any soil samples as part of this investigation.

4.3.5 Task 10—Sediment Sampling

WESTON will collect drainage ditch and stream bottom sediment samples at 25 sample stations (D01 through D25) during field investigation in order to document the extent of contaminant migration in the surface water pathway. The sediment samples that WESTON will collect are summarized in Tables 4-2 and 4-3 and shown on Figures 4-1 and 4-2.

Drainage ditch sediment samples will be collected at four sample stations (D01 through D04) from the on-site drainage ditch bordering pits 1 through 3. The drainage ditch samples will be collected from the 0-to-24 inch depth interval using disposable plastic scoops or a hand core sediment sampler.

The stream bottom sediment samples will be collected from the 0-to-6 inch depth interval using a deep lake bottom dredge. This type of sampler is designed to collect all types of benthos sediments on all varieties of bottoms, except those of the hardest clay. A hand core sediment sampler with extension handles will be used if the bottom consistency is too hard or vegetated to allow the dredge sampler to work effectively. Bottom sediment samples will be collected at 21 sample stations (D05 through D25) in Bayou La Carpe, the Houma Navigational Canal, the Intracoastal Waterway, and Bayou Black. The samples will be collected at seven cross-sections of the streams, detailed as follows: three sample locations will be located at each cross-section, and will consist of one sample collected from the middle of the channel and one sample collected near each bank.

WESTON will use a moderate size boat to traverse the streams and travel between sampling locations. When the appropriate sampling location has been identified, an anchor will be deployed from the boat, if necessary, to maintain position. A rod will then be used to probe the consistency of the bottom sediments to determine the appropriate sampling device. If necessary, the boat will be equipped with a tripod and winch system for dredge sampler retrieval.

4.3.6 Task 11—Surface Water Sampling

WESTON will collect surface water samples at three sample stations (W01 through W03) to determine if nearby drinking water intakes along the Intracoastal Waterway and Bayou Black have been impacted by hazardous contamination. The surface water samples that WESTON will collect are summarized in Tables 4-2 and 4-3 and shown on Figure 4-2.

4.3.7 Task 12—Groundwater Sampling

WESTON will not collect any groundwater samples because there are no identified drinking water wells located within 1 mile of the site (LDOTD, 1996).

4.3.8 Task 13—Quality Assurance/Quality Control

As part of the site investigation, quality assurance/quality control (QA/QC) samples will be collected to verify the validity of the laboratory results and to determine if the sample integrity may have been compromised as a result of field or laboratory procedures. The specific QA/QC samples that will be collected are summarized in Tables 4-2 and 4-3, and described in the following paragraphs.

Blind duplicate samples will be collected at a frequency of 1 per 10 samples for each sample matrix, and submitted with the original samples in order to evaluate the reproducibility of the laboratory methods and results. Efforts will be made to collect the duplicate sample in a location where there is either visual evidence of contamination, or where contamination is suspected. The duplicate sample will be a split or replicate of the original sample and will be submitted for the same laboratory analyses as the original. To this end, blind field duplicate samples will be collected at sample stations D02, D03, D05, P06, and W02.

Equipment blank samples will be collected at a frequency of 1 per day to evaluate the effectiveness of decontamination procedures. The samples will be collected by pouring deionized water over decontaminated equipment (i.e. hand core or dredge sediment sampler) and collecting the rinse water in the appropriate sample containers.

4.3.9 Task 14—Sample Management

WESTON will manage the samples collected during the ESI in a manner consistent with EPA and EPA CLP guidelines. Specific guidelines are provided in the following subsections. Additional guidelines are provided in Appendix D.

4.3.9.1 Sample Container Decontamination

When a sample is collected and returned to the command post, the Sample Manager will see that the outside of each container is decontaminated. To decontaminate the sample containers, each sample container will be washed with deionized water and dried with a paper towel.

4.3.9.2 Sample Documentation

Each sample will be appropriately documented and identified using the appropriate EPA CLP labels, tags, and forms. The following guidelines will be used:

- Each sample station will receive a set of CLP sample numbers. Samples for organic analysis will receive sample numbers beginning with "F," the inorganic samples will receive sample numbers beginning with "M," and samples for special analyses will receive sample numbers beginning with "S."

- Each bottle or jar for a sample station will receive a sample number sticker, a sample tag, and a custody seal.

- The sample information will be written on the appropriate traffic reports/chain-of-custody forms, which will remain with the samples.

Additional information regarding sample documentation procedures is included in Appendix C.

4.3.9.3 Sample Packaging

Once labeling is completed, the Sample Manager and field team leader will review the sample documentation for accuracy before the samples are packaged for shipping. Once this QA check is completed, the samples will be packaged in coolers using the following guidelines:

- Each sample bottle or jar will be placed within a lock-top bag, which will be subsequently sealed.

- The bottles and jars will be placed into coolers. Samples for organic, inorganic, and special analyses will be placed into different coolers, as they typically will be going to different laboratories.

- Vermiculite will be poured and packed into the spaces around the sample containers to fill empty space and help prevent breakage during transport.

- At least two lock-top bags filled with ice will be placed on the samples in each cooler to help maintain the ice chest temperature at approximately 4 °C. Additional vermiculite may be added on top of the ice to fill the cooler.

- The appropriate traffic report/chain-of-custody forms (laboratory copies only) will be sealed inside a plastic lock-top bag and taped to the inside of the cooler lid.

- The coolers will then be closed, and they will be sealed with strapping or packing tape and at least two EPA custody seals (on opposite sides of the cooler). Also, if samples need to be left unattended, they will be packed in a cooler and the cooler will be sealed with custody tape and stored in a secured place.

4.3.9.4 Sample Shipping

When sampling is completed for a given day, the sampling team will ship the samples by Federal Express Priority Overnight Service (at government rate) to the assigned laboratories for analytical testing. The names and addresses of the laboratories will be provided by EPA by the Friday prior to the week that sampling activities are scheduled. Additionally, WESTON will subcontract a laboratory to perform high concentration CLP compatible data analyses for the samples to be collected from the on-site pits. After shipping the samples, the Sample Manager will contact the EPA Contract Laboratory Analytic Services Support (CLASS) with information concerning the shipment.

4.3.10 Task 15—Sample Receipt Form Completion

Following sampling activities at the site or at off-site locations, the WESTON field team leader will provide an EPA Receipt for Samples form to the representatives of the property sampled. The property representatives need to sign these forms, and the field team leader should provide the property owners with a carbon copy of the signed form. These forms will identify the date, location, and type of each sample collected. The forms will be forwarded to EPA as part of the final ESI report. An example Receipt for Samples form is included in Appendix D.

4.4 DEMOBILIZATION AND OTHER ACTIVITIES

The remaining tasks will be completed by the field team after all samples are collected and shipped and after the field team leader acquires the consent of the WESTON PTL or Site Manager.

4.4.1 Task 16—Demobilization

Following the completion of all sampling activities, the field team will decontaminate, package, and transfer all nondisposable sampling equipment back to the WESTON RES warehouse in Houston, Texas. The command post and decontamination areas will also be dismantled. WESTON will, as possible, leave the site in the same condition it was prior to the investigation.

4.4.2 Task 17—Decontamination Rinsate Water Disposal or Staging

After completing sampling activities, the field team leader will request permission from the site representative, if present, to dispose of the decontamination rinsate water in a known or suspected source area at the site. If permission is granted, the water will be disposed of on-site. If the site representative is not present during the fieldwork and the site is inactive and abandoned, WESTON generally will dispose of the water on-site unless the site representative has previously objected to this practice. The WESTON PTL will inform the site representative of WESTON's intent to dispose of the rinsate water on-site when the field team leader is notified of the dates of the sampling visit.

If the site representative will not grant permission for on-site rinsate water disposal, the rinsate water will be transferred to a small drum. The rinsate water will be sampled using protocol

similar to that used for surface water sampling. The drum of water then will be sealed with EPA custody tape, labeled, and staged in an area of the site designated by the site representative.

4.4.3 Task 18—Background Information Acquisition

While in the field, the WESTON field team leader and other designated personnel may collect background information needed to close project data gaps, as time allows. Activities may include visiting city offices to collect local agency file information and to obtain maps, locating water wells in the area, or driving along the surface water pathway to visually document fisheries and wetlands. Background research tasks will be assigned to the field team leader by the PTL once sampling activities are completed. In general, only one or two of the field team members will be assigned background research tasks and only if time allows.

4.5 COMMUNITY RELATIONS

Persons requesting site information from the WESTON field team will be instructed to submit a Freedom of Information Act Request to Freedom of Information Officer, U.S. EPA Region VI, 1445 Ross Avenue, Dallas, Texas 75202-2733. Reporters will be instructed to contact EPA's Office of External Affairs at (214) 665-2200 or contact the EPA representative in the field if one is present. The WESTON field team leader will notify the WESTON PTL or Site Manager immediately, if reporters are present at the site. WESTON personnel in the office in turn will notify the EPA WAM.

4.6 FIELD FOLLOWUP MEMORANDUM

As stated in WESTON's Generic Expanded Site Inspection Work Plan, WESTON will submit a memorandum to the WAM describing any alterations that were made to the work plan in the field. This memorandum will also serve to notify the WAM of any conditions observed at the site that appeared to represent an imminent threat.

4.7 REPORT PREPARATION

After receipt of the validated analytical data, WESTON will prepare the final report for the ESI. The report will contain information as specified in WESTON's Generic Expanded Site Inspection Work Plan and by regional guidance. The report format will include the following:

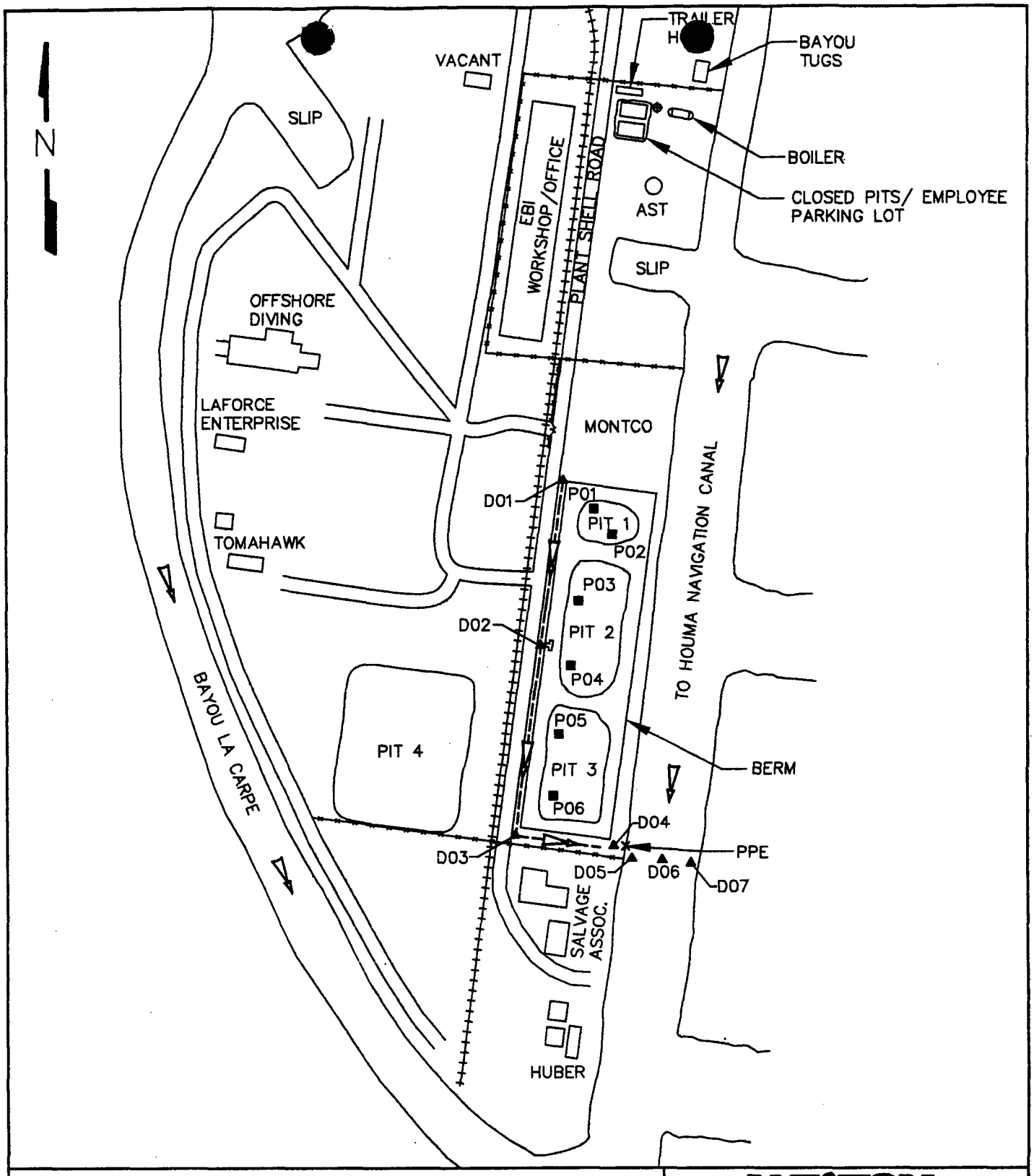
- An introduction describing the background and purpose of the investigation.
- A site characteristics section describing the site location, operating history, source waste characteristics, and site concerns.
- A sampling activities section describing the field activities completed during the ESI.

- Individual sections for the groundwater, surface water, soil exposure, and air pathways, describing the environmental conditions at the site, likelihood of a release, targets, and relevant analytical data.

- A summary and conclusions section discussing the major site concerns.

- A reference list.

- Photographs, field notes, and other reference material (included as appendices).



LEGEND:

- OVERFLOW PIPE
- FENCE
- FLOW DIRECTION
- DRAINAGE DITCH
- MONITORING WELL
- SEDIMENT SAMPLE STATION
- WASTE SAMPLE STATION

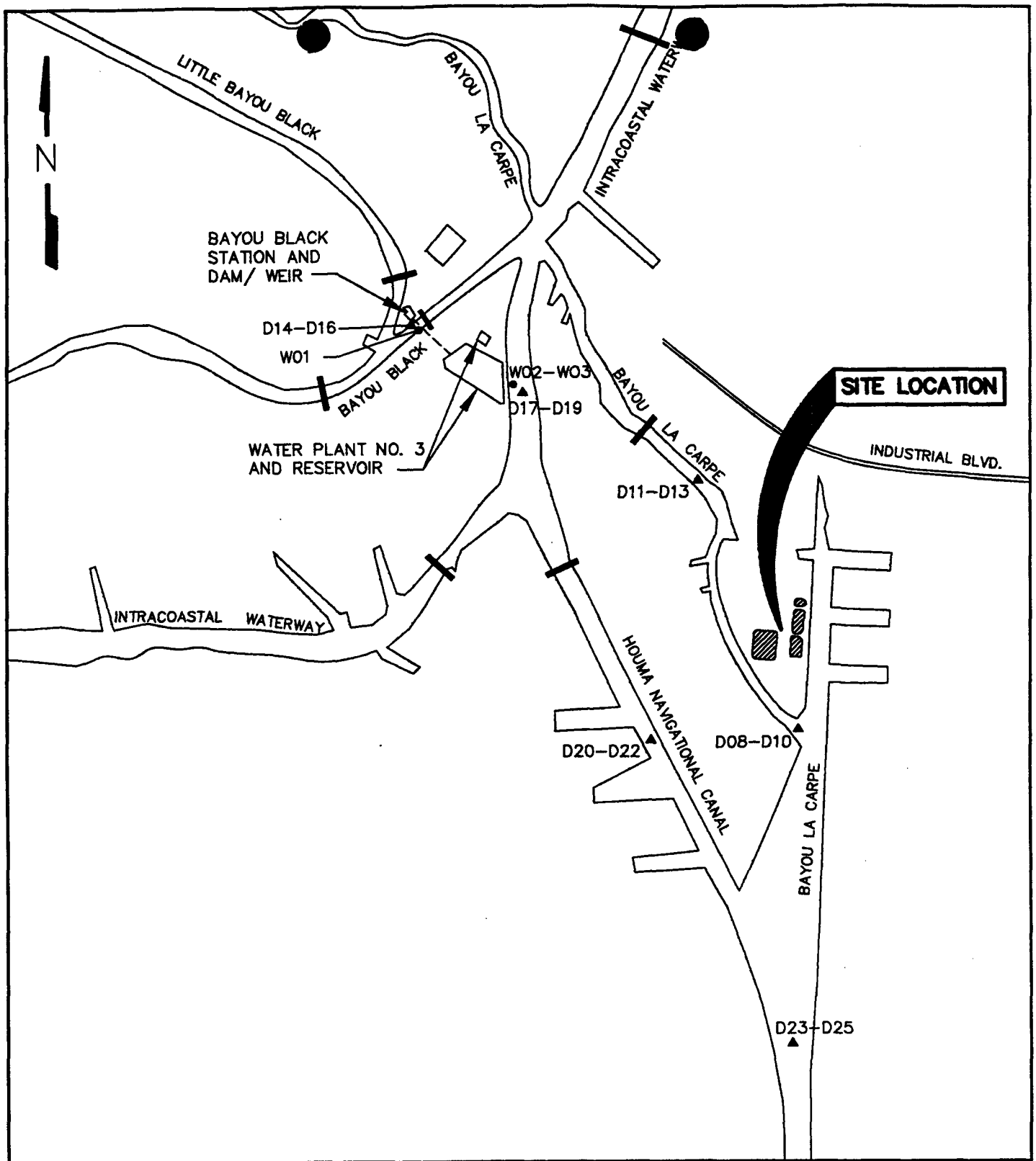
0 200 400
SCALE IN FEET

WESTON
MANAGERS DESIGNERS/CONSULTANTS

FIGURE 4-1

ON-SITE SAMPLE STATION
LOCATION MAP
DELTA SHIPYARD
HOUMA, LOUISIANA
CERCLA ID. NO. : LAD058475419
EPA REGION VI
ARCS EXPANDED SITE INSPECTION
W.O. NO. : 04603-026-031-0300

H:\ARCS\ARC2631\0300C.PA.JC 1=1 06-25-96 (PCP=ARCS)



LEGEND:

- BRIDGE
- ▲ SEDIMENT SAMPLE STATION
- • SURFACE WATER SAMPLE STATION

0 1000 2000
SCALE IN FEET

WESTON
MANAGERS DESIGNERS/CONSULTANTS

FIGURE 4–2
STREAM SAMPLE LOCATION MAP
DELTA SHIPYARD
HOUMA, LOUISIANA
CERCLA ID. NO. : LAD058475419
EPA REGION VI
ARCS EXPANDED SITE INSPECTION
W.O. NO. : 04603–026–031–0300

H:\ARCS\ARC2631\0300C.PA.JC 1=1 06–24–96 (PCP=ARCS)

TABLE 4-1

ANTICIPATED PROJECT PERSONNEL

NAME	TITLE	ROLES	PROJECT RESPONSIBILITIES
Eric Tate	Assistant Engineer II	Project Team Leader/ Field Team Leader	• Project coordination in the WESTON office. • Implementation of the Task Work Plan in the field and final sample location selection. • Sampling oversight and quality control. • Logbook documentation and photography. • Public relations and client interactions.
Dennis Hayes	Associate Geologist	Site Safety Officer	• Implementation of the Health and Safety Plan in the field. • Safety oversight. • Air monitoring equipment calibration. • Sample collection. • Equipment management and decontamination.
Pam Quackenbush	Associate Engineer	Sample Manager	• Sample documentation, packaging, and shipping. • EPA CLASS/RSCC coordination. • Sample management. • Equipment management and decontamination. • Mobilization/Demobilization.

Table 4-2
Delta Shipyard (CERCLIS ID LAD058475419)
Sampling Station Descriptions and Rationales

Station Identification/Type	**Description**	**Rationale**	**Sample** Identification/QC Type
D01 Background	Drainage ditch sample located approximately 400 feet north of the Pit 2 overflow pipe.	Low concentration sediment sample collected to establish on-site background constituent concentrations.	D01-51-1 Normal
D02 Characterization	Drainage ditch sample located beneath the Pit 2 overflow pipe.	Low concentration sediment sample collected to document contamination in the overland flow path.	D02-51-1 Normal D02-52-1 Duplicate
D03 Characterization	Drainage ditch sample located near the southwestern corner of Pit 3.	Low concentration sediment sample collected to document contamination in the overland flow path.	D03-51-1 Normal D03-52-1 Duplicate
D04 Characterization	Drainage ditch sample located at the probable point of entry to the surface water pathway.	Low concentration sediment sample collected to document contamination in the overland flow path.	D04-51-1 Normal
D05 Characterization	Located in Bayou La Carpe at the PPE.	Low concentration sediment sample collected to document contamination in the surface water pathway.	D05-51-1 Normal D05-52-1 Duplicate
D06 Characterization	Located in Bayou La Carpe at the PPE.	Low concentration sediment sample collected to document contamination in the surface water pathway.	D06-43-1 Rinsate Blank D06-51-1 Normal
D07 Characterization	Located in Bayou La Carpe at the PPE.	Low concentration sediment sample collected to document contamination in the surface water pathway.	D07-51-1 Normal
D08 Characterization	Located approximately 500 feet south of the site at the fork in Bayou La Carpe.	Low concentration sediment sample collected to document contamination in the surface water pathway.	D08-51-1 Normal

Table 4-2 (Continued)
Delta Shipyard (CERCLIS ID LAD058475419)
Sampling Station Descriptions and Rationales

Station Identification/Type	Description	Rationale	Sample Identification/QC Type
D09 Characterization	Located approximately 500 feet south of the site at the fork in Bayou La Carpe.	Low concentration sediment sample collected to document contamination in the surface water pathway.	D09-51-1 Normal
D10 Characterization	Located approximately 500 feet south of the site at the fork in Bayou La Carpe.	Low concentration sediment sample collected to document contamination in the surface water pathway.	D10-51-1 Normal
D11 Characterization	Located in Bayou La Carpe, approximately 4,000 feet downstream of the confluence with the Intracoastal Waterway, and approximately 2,000 feet north of the site.	Low concentration sediment sample collected to document contamination in the surface water pathway.	D11-51-1 Normal
D12 Characterization	Located in Bayou La Carpe, approximately 4,000 feet downstream of the confluence with the Intracoastal Waterway, and approximately 2,000 feet north of the site.	Low concentration sediment sample collected to document contamination in the surface water pathway.	D12-51-1 Normal
D13 Characterization	Located in Bayou La Carpe, approximately 4,000 feet downstream of the confluence with the Intracoastal Waterway, and approximately 2,000 feet north of the site.	Low concentration sediment sample collected to document contamination in the surface water pathway.	D13-51-1 Normal
D14 Background	Located near the drinking water intake along Bayou Black.	Low concentration sediment sample collected to establish off-site background constituent concentrations in the surface water pathway.	D14-51-1 Normal
D15 Background	Located near the drinking water intake along Bayou Black.	Low concentration sediment sample collected to establish off-site background constituent concentrations in the surface water pathway.	D15-43-1 Rinsate Blank D15-51-1 Normal
D16 Background	Located near the drinking water intake along Bayou Black.	Low concentration sediment sample collected to establish off-site background constituent concentrations in the surface water pathway.	D16-51-1 Normal
D17 Characterization	Located near the Water Plant No. 3 drinking water intake along the Intracoastal Waterway.	Low concentration sediment sample collected to document contamination in the surface water pathway.	D17-51-1 Normal

Table 4-2 (Continued)
Delta Shipyard (CERCLIS ID LAD058475419)
Sampling Station Descriptions and Rationales

Station Identification/Type	**Description**	**Rationale**	**Sample** Identification/QC Type
D18 Characterization	Located near the Water Plant No. 3 drinking water intake along the Intracoastal Waterway.	Low concentration sediment sample collected to document contamination in the surface water pathway.	D18-51-1 Normal
D19 Characterization	Located near the Water Plant No. 3 drinking water intake along the Intracoastal Waterway.	Low concentration sediment sample collected to document contamination in the surface water pathway.	D19-51-1 Normal
D20 Characterization	Located in the Houma Navigational Canal, approximately 4,000 feet downstream of the confluence with the Intracoastal Waterway.	Low concentration sediment sample collected to document contamination in the surface water pathway.	D20-51-1 Normal
D21 Characterization	Located in the Houma Navigational Canal, approximately 4,000 feet downstream of the confluence with the Intracoastal Waterway.	Low concentration sediment sample collected to document contamination in the surface water pathway.	D21-51-1 Normal
D22 Characterization	Located in the Houma Navigational Canal, approximately 4,000 feet downstream of the confluence with the Intracoastal Waterway.	Low concentration sediment sample collected to document contamination in the surface water pathway.	D22-51-1 Normal
D23 Characterization	Located in the Houma Navigational Canal, approximately 2,000 feet downstream of the confluence with Bayou La Carpe.	Low concentration sediment sample collected to document contamination in the surface water pathway.	D23-51-1 Normal
D24 Characterization	Located in the Houma Navigational Canal, approximately 2,000 feet downstream of the confluence with Bayou La Carpe.	Low concentration sediment sample collected to document contamination in the surface water pathway.	D24-51-1 Normal
D25 Characterization	Located in the Houma Navigational Canal, approximately 2,000 feet downstream of the confluence with Bayou La Carpe.	Low concentration sediment sample collected to document contamination in the surface water pathway.	D25-43-1 Rinsate Blank D25-51-1 Normal
P01 Characterization	Located in Pit 1	High concentration waste sample collected for source characterization.	P01-71-1 Normal
P02 Characterization	Located in Pit 1.	High concentration waste sample collected for source characterization.	P02-43-1 Rinsate Blank P02-71-1 Normal

Table 4-2 (Continued)
Delta Shipyard (CERCLIS ID LAD058475419)
Sampling Station Descriptions and Rationales

Station Identification/Type	**Description**	**Rationale**	**Sample** Identification/QC Type
P03 Characterization	Located in Pit 2.	High concentration waste sample collected for source characterization.	P03-71-1 Normal
P04 Characterization	Located in Pit 2.	High concentration waste sample collected for source characterization.	P04-71-1 Normal
P05 Characterization	Located in Pit 3.	High concentration waste sample collected for source characterization.	P05-71-1 Normal
P06 Characterization	Located in Pit 3.	High concentration waste sample collected for source characterization.	P06-71-1 Normal P06-72-1 Duplicate
W01 Background	Located at the drinking water intake at the Bayou Black pump station.	Low concentration surface water sample collected to establish background constituent concentrations in the surface water pathway.	W01-11-1 Normal
W02 Characterization	Located at the Water Plant No. 3 drinking water intake along the Intracoastal Waterway.	Low concentration pre-treatment water sample collected to document contamination in the surface water pathway.	W02-11-1 Normal W02-12-1 Duplicate
W03 Characterization	Located at the Water Plant No. 3 along the Intracoastal Waterway.	Low concentration post-treatment water sample collected to document contamination in the surface water pathway.	W03-11-1 Normal

EXPANDED SITE INSPECTION
TASK WORK PLAN

DELTA SHIPYARD
HOUMA, TERREBONNE PARISH, LOUISIANA
EPA CERCLA ID NO. LAD058475419

TABLE 4-3

SAMPLING INFORMATION

SAMPLE MATRIX	NUMBER AND TYPE OF CONTAINERS REQUIRED PER SAMPLE	ANALYSES REQUIRED	SAMPLE PRESERVATION REQUIRED
Waste	Two 4 oz. glass jars	Volatiles	Cool to 4 °C
	One 8 oz. glass jar	BNAs/Pesticides/PCBs	Cool to 4 °C
	One 8 oz. glass jar	Metals/Cyanide	Cool to 4 °C
Sediment	Two 4 oz. glass jars	Volatiles	Cool to 4 °C
	One 8 oz. glass jar	BNAs/Pesticides/PCBs	Cool to 4 °C
	One 8 oz. glass jar	Metals/Cyanide	Cool to 4 °C
Water	Two 40-mL vials	Volatiles	Cool to 4 °C
	Four 1-L glass bottle	BNAs/Pesticides/PCBs	Cool to 4 °C
	One 500 mL plastic bottle	Total Metals	Cool to 4 °C and preserve with NaOH
	One 500 mL plastic bottle	Cyanide	Cool to 4 °C and preserve with HNO_3

SECTION 5
PROJECT INFORMATION

This section outlines basic project management information for the ESI. Details concerning key personnel and the project schedule are provided. Reference should be made to WESTON's Generic Expanded Site Inspection Work Plan (WESTON Document Control Number 4603-26-0002) for more detailed information concerning WESTON's project management plan.

5.1 KEY PROJECT PERSONNEL

The anticipated key project personnel for this ESI assignment are shown on Figure 5-1.

5.2 PROJECT SCHEDULE

The overall project schedule is summarized in Table 5-1.

5.3 SAMPLING VISIT SCHEDULE

Sunday	8:00 p.m.	Team members arrive in Houma, Louisiana.
Monday	8:00 a.m.	Team arrives at site and conducts site health and safety meeting. Samplers establish command post. Field Team Leader and Sample Manager prepare sample tags and labels.
	9:00 a.m.	Team collects waste and drainage ditch sediment samples. Sample Manager documents samples.
	12:00 p.m.	Lunch.
	1:00 p.m.	Team verifies sample documentation and packages samples.
	4:00 p.m.	Field Team Leader and Sample Manager depart for Federal Express to ship samples. Samplers decontaminate and load equipment and depart the site for the day.
Tuesday	8:00 a.m.	Team arrives at site and holds brief safety meeting. Samplers establish command post. Field Team Leader and Sample Manager prepare sample tags and labels.
	9:00 a.m.	Team launches boat and collects stream bottom sediment samples. Sample Manager documents samples.

	2:00 p.m.	Return to shore. Team verifies sample documentation and packages samples.
	4:00 p.m.	Field Team Leader and Sample Manager depart for Federal Express to ship samples. Samplers decontaminate and load equipment and depart the site for the day.
Wednesday	8:00 a.m.	Team arrives at the site and holds brief safety meeting. Samplers establish command post. Field Team Leader and Sample Manager prepare sample tags and labels.
	9:00 a.m.	Team launches boat and collects stream water and bottom sediment samples. Sample Manager documents samples.
	2:00 p.m.	Return to shore. Team verifies sample documentation and packages samples.
	4:00 p.m.	Field Team Leader and Sample Manager depart for Federal Express to ship samples. Samplers decontaminate and load equipment and depart the site for the day.
Thursday	8:00 a.m.	Team arrives at the site and holds brief safety meeting. Samplers establish command post. Field Team Leader and Sample Manager prepare sample tags and labels.
	9:00 a.m.	Team launches boat and collects the remainder of the stream water and bottom sediment samples. Sample Manager documents samples.
	2:00 p.m.	Return to shore. Team verifies sample documentation and packages samples.
	4:00 p.m.	Field Team Leader and Sample Manager depart for Federal Express to ship samples. Samplers decontaminate and load equipment and depart the site for the day. Team demobilizes and returns to Houston.
Friday		Contingency

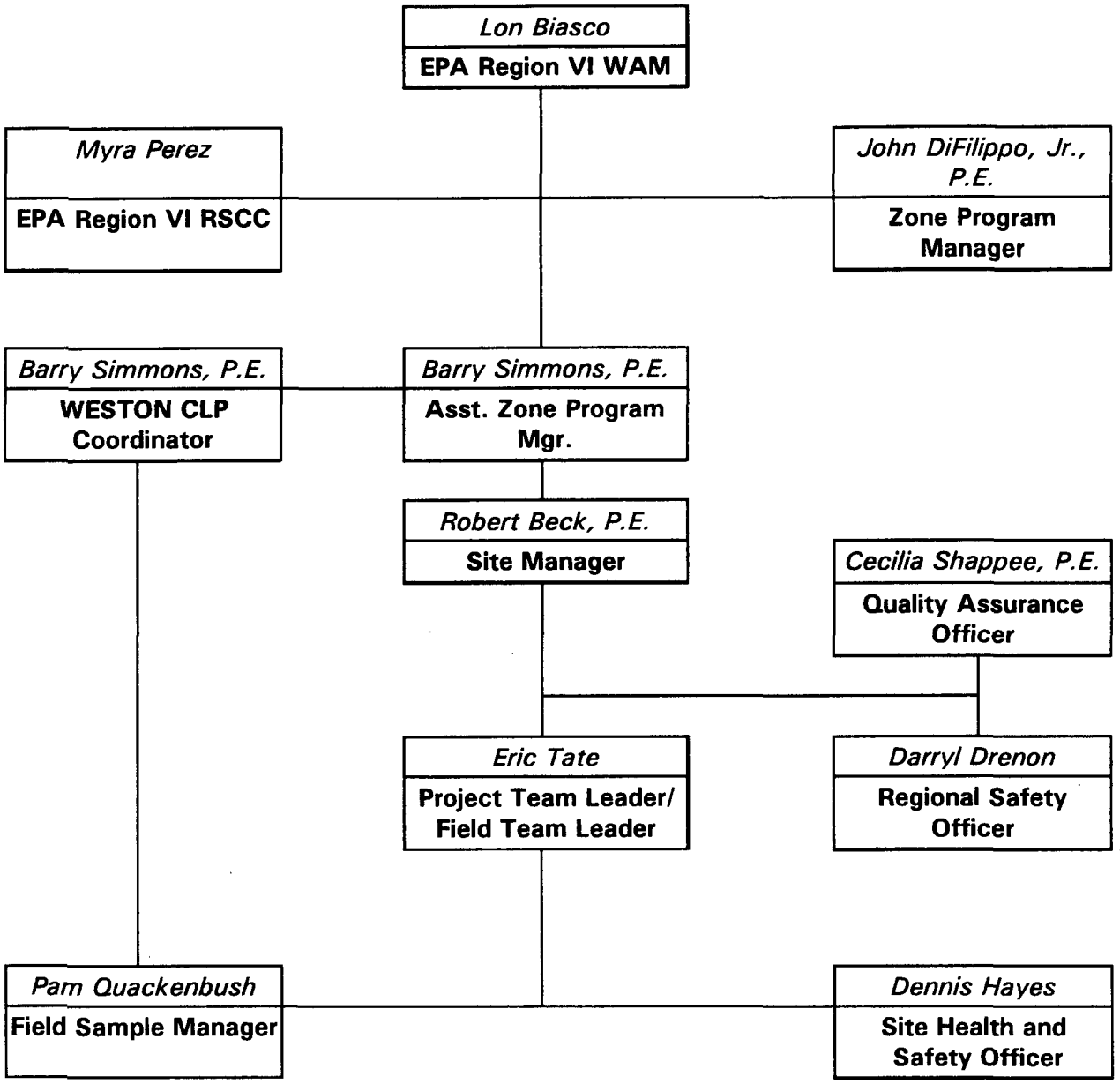
5.4 IMPORTANT PHONE NUMBERS

Important phone numbers that may be needed by the field team leader include the following:

- Local Hospital: (504) 873-2200
- WESTON 24-hour Emergency: (800) 229-3674
- WESTON Office: (713) 621-1620

- WESTON RES: (713) 957-3267
- WESTON RES PAGER: (800) 409-2261
- EPA WAM (Lon Biasco): (214) 665-6673
- EPA RSSC (Myra Perez/Christy McDowell): (713) 983-2130/(713) 983-2137
- EPA (CLASS-Jonathan Rude): (703) 519-1471
- Place of Lodging in the Field: To be determined
- Federal Express (National): (800) 238-5355

FIGURE 5-1
ANTICIPATED KEY PERSONNEL



EXPANDED SITE INSPECTION
TASK WORK PLAN

DELTA SHIPYARD
HOUMA, TERREBONNE PARISH, LOUISIANA
EPA CERCLA ID NO. LAD058475419

TABLE 5-1

PROJECT SCHEDULE
(1996)

TARGET MILESTONES	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER
SITE RECONNAISSANCE								
WORK PLAN SUBMITTAL TO EPA								
WORK PLAN REVIEW/APPROVAL BY EPA								
LABORATORY SPACE REQUEST								
EQUIPMENT MOBILIZATION								
FIELD SAMPLING VISIT								
DATA ANALYSIS BY EPA LAB/CLP LAB								
DATA VALIDATION BY EPA								
REPORT WRITING								
REPORT QUALITY ASSURANCE								
REPORT SUBMISSION								

SECTION 6
REFERENCE LIST

Dave, N., and R. Adams. 1980. Soil Testing Engineers. Personal Communication with Horace Thibodaux, Director of Environmental Research, T. Baker Smith and Sons, Inc. 26 November 1980.

Dussel, C. 1985. Wink Engineering. Personal Communication with Glenn Miller, Louisiana Department of Environmental Quality. 5 July 1985.

Ecology and Environment, Inc. 1981. *EPA Potential Hazardous Waste Site Identification and Preliminary Assessment*. 11 March 1981.

Ishigo, J. 1996a. WESTON. Personal Communication with Bryan Sampey, Plant Manager, Houma Public Water Plant. 5 March 1996.

Ishigo, J. 1996b. WESTON. Personal Communication with Gerald Adkins, Fishery Biologist, Louisiana Department of Wildlife and Fisheries. 14 March 1996.

LDOTD (Louisiana Department of Transportation and Development). 1996. Water Well Information.

Rettig, V. 1996. U.S. Fish and Wildlife Service. Personal Communication with Joy Ishigo, WESTON. 5 March 1996.

Tate, E. 1996. WESTON. Field Logbook Notes for the Delta Shipyard Site. WESTON Document Control Number 4603-026-059.

The Earth Technology Corporation. 1984. *EPA Potential Hazardous Waste Site, Site Inspection Report: Delta Shipyard*. 12 September 1984.

U.S. Fish and Wildlife Service. 1991 and 1992. Dulac, Houma, and Lake Quitman, Louisiana (7.5-minute National Wetlands Inventory maps).

USGS (U.S. Geological Survey). 1963. Photorevised 1980. Houma, Louisiana (7.5-minute series topographic map).

WESTON. 1994. *Site Inspection Prioritization Report and PREscore Package: Delta Shipyard*. December 1994.

WESTON (Roy F. Weston, Inc.). 1996. "Standard Operating Procedure to Determine Site Latitude and Longitude." Calculation Worksheet for the Delta Shipyard Site. 12 February 1996.

APPENDIX A

SITE ACCESS AGREEMENT

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 6
1445 ROSS AVENUE, SUITE 1200
DALLAS, TEXAS 75202-2733

7 February 1996

URGENT LEGAL MATTER - PROMPT REPLY NECESSARY

CERTIFIED MAIL/RETURN RECEIPT REQUESTED - Z 348 084 297

EPA I.D. NO.: LAD058475419

ATTN: Mr. Lynn Dean
No. 1 Dean Street
Braithwaite, Louisiana 70040

RE: EPA Expanded Site Inspection
Site Access Request
Delta Shipyard, Houma, Louisiana

Dear Mr. Dean:

The purpose of this letter is to request you to voluntarily permit the U.S. Environmental Protection Agency (EPA), and its officers, employees or representatives, authorized by EPA, including but not limited to Roy F. Weston, Inc. (WESTON®), (Contract No. 68-W9-0015), access to the above referenced property located at 201 Industrial Boulevard in Houma, Louisiana so that EPA can enforce the provisions of the Comprehensive Environmental Responsibility Compensation and Liability Act (CERCLA), as amended, 42 U.S.C. § 9601 et seq., copy pertinent documents or records, inspect the site, and obtain samples of any suspected hazardous substance or pollutant or contaminant found on site. A description of the property or a map identifying the site for which access is required is attached.

Specifically, WESTON has been requested by the EPA, Region 6 to conduct an Expanded Site Inspection of the Delta Shipyard Site to further assess the degree of risk to the public health, welfare, and environment related to hazardous substances, pollutants or contaminants that may be present at the site. Based on preliminary file information, EPA finds it necessary to perform this Expanded Site Inspection at your site pursuant to 40 CFR 300.400 Subpart E.

Section 104(e) of CERCLA, 42 U.S.C. Section 9604(e), explicitly grants EPA the authority to enter a property at reasonable times to inspect and obtain samples from any location of any suspected hazardous substance or pollutant or contaminant. Further, the cited section authorizes EPA to require any person who has or may have information relating to any of the following to furnish information or documents relating to:

1. The identification, nature and quantity of materials which have been or are generated, treated, stored, or disposed of at vessel or facility, or transported to a vessel or facility;
2. The nature or extent of a release of a hazardous substance, or pollutant, or contaminant at or from a vessel or facility;
3. Information relating to the ability of a person to pay for or perform a cleanup.

It is EPA policy to seek voluntary cooperation from the public when possible. Consequently, EPA is making this request for access to the property and records mentioned above. EPA hopes that you will voluntarily comply by signing, dating and returning the enclosed Consent for Access to Property, to the address indicated below within seven days of your receipt of this letter. Please mail it to:

Eddie Sierra
Superfund Site Assessment (6SF-RA)
USEPA Region 6
1445 Ross Avenue, Suite 1200
Dallas, Texas 75202-2733

If EPA does not receive the enclosed consent for access to the property, signed and dated by you, EPA will treat your failure to respond as a denial of access. Please note that EPA will not agree to conditions which will restrict or impede the manner or extent of an inspection or response action, impose indemnity or compensatory obligations on EPA, or operate as a release of liability. Should you impose conditions of this nature in the consent for access to the property, EPA will treat this as a denial of consent.

Failure to grant EPA access may result in the issuance of an order directing compliance with EPA's request for access. Failure to comply with such an order may result in a civil action in United States District Court to enjoin compliance with the order. EPA may also seek the assessment of a civil penalty not to exceed $25,000 per day of noncompliance with the order. You may assert a business confidentiality claim covering part of the information you submit in response to this request. Any such claim must be made by placing on (or attaching to) the information, at the time it is submitted to EPA, a cover sheet or a stamped or typed legend or other suitable form of notice employing language such as "trade secret," "proprietary," or "company confidential." Confidential portions of otherwise nonconfidential documents should be clearly identified and may be submitted separately to facilitate identification and handling by EPA. If you make such claim, the information by that claim will be disclosed by EPA only to the extent, and by the means of the procedures, set forth in Subpart B of 40 CFR Part 2. If no such claim accompanies the information when it is received by EPA, it may be made available

to the public without further notice to you. The requirements of 40 CFR Part 2 regarding business confidentiality claims were published in the Federal Register on September 1, 1976, and amended on September 8, 1978, and December 18, 1985.

As part of the information gathering process, the collection of samples from your site may become necessary. This collection process may generate investigation derived wastes (IDWs) such as equipment, rinsate water, or disposable personal protective clothing. WESTON will manage these IDWs in the most responsible manner consistent with EPA policy regarding these wastes, which is to leave site conditions essentially unchanged, such as to return soil cuttings to the location from which they were taken or properly to dispose of the IDWs.

Field inspection activities are tentatively planned for May 1996 through June 1996. You will be given at least two (2) weeks notice prior to the site visit. Eric Tate will be contacting you to verify the exact dates of this visit. During the visit you will be provided with a receipt describing any samples obtained and, if you so request, you will be given a portion of each sample. There will be no charge for the samples EPA provides you. If you would like a portion of each sample, please put a check mark in the space provided in the enclosed consent for access to property. If you do not wish to be provided with a portion of each sample, please put a check mark in the alternative space. If you do not mark any space, EPA will treat your failure to respond as your statement that you do not wish to be provided with a portion of each sample.

You can obtain a copy of the resulting inspection report and analytical data by writing to Ed Sierra, Chief, Superfund Site Assessment Section (6SF-RA), EPA Region 6, 1445 Ross Avenue, Suite 1200, Dallas, Texas 75202-2733.

In future inquiries, please indicate your site's EPA I.D. Number and name as listed, to ensure prompt processing. If you have any questions concerning this matter, please contact me at (214) 665-6740.

Sincerely,

Eddie Sierra
Superfund Site Assessment
EPA Region 6

cc: Tim Knight
LDEQ - Inactive and Abandoned Sites Division
P. O. Box 82282
Baton Rouge, LA 70884-2282

bcc: D. Gray (6X)
V. McFarland (6SF-P)
M. Peycke (6SF-DL)

In future inquiries, please indicate your site's EPA I.D. Number and name as listed, to ensure prompt processing. If you have any questions concerning this matter, please contact me at (214) 665-6740.

Sincerely,

Eddie Sierra
Superfund Site Assessment
EPA Region 6

cc: Tim Knight
LDEQ - Inactive and Abandoned Sites Division
P. O. Box 82282
Baton Rouge, LA 70884-2282

arcs:46032631:dean.126(lcd)

CONSENT FOR ACCESS TO PROPERTY

Name: Lynn Dean

EPA I.D. No.: LAD058475419
Site Name: Delta Shipyard, Houma, Louisiana

Description of Property: The Delta Shipyard is located at 201 Industrial Boulevard in Houma, Louisiana (see attached site location map).

I hereby consent to officers, employees, and representatives authorized by the United States Environmental Protection Agency (EPA) entering and having continued access to my property for the following purposes:

1. Reviewing and copying documents related to the site;
2. The taking of such soil, water and air samples as may be determined to be necessary;
3. The sampling of any solids or liquids stored or disposed of on property;
4. The drilling of holes and the installation of monitoring wells for subsurface investigation of subsurface contamination.

I realize that these actions are undertaken pursuant to EPA's response and enforcement responsibilities under the Comprehensive Environmental Responsibility, Compensation, and Liability Act, as amended (CERCLA), 42 U.S.C. § 9601 et seq., as well as 40 CFR Part 300.400 Subpart E.

I am the property owner, or a responsible agent of the property owner, and I warrant that I have the authority to enter into this access agreement.

Place a check mark in the appropriate space. Please note that if no selection is made EPA will assume that you do not wish to be provided with a portion of the sample.

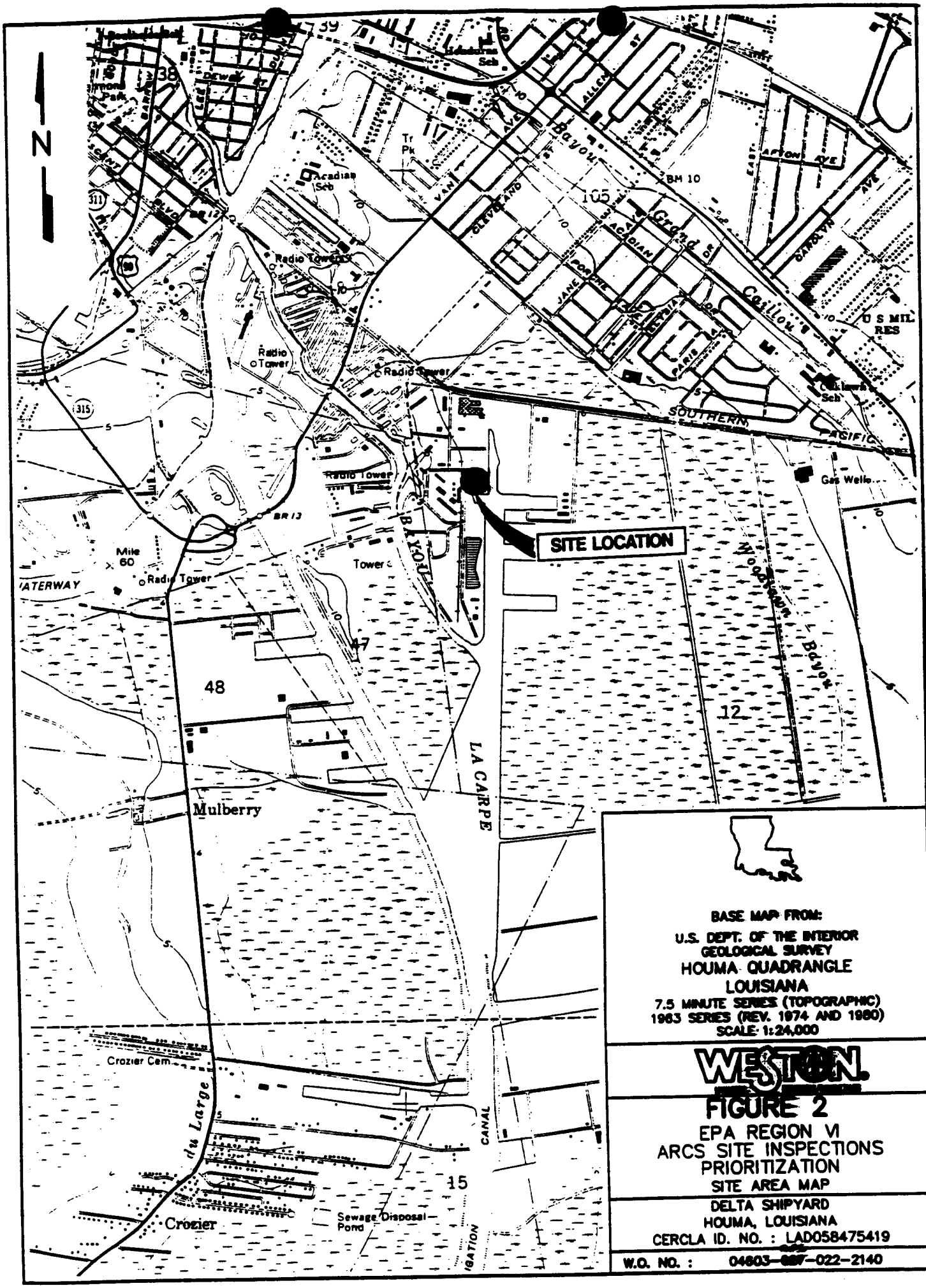
( ) Please provide me with a portion of each sample taken at the property described above. I understand that there will be no charge for the sample portions provided by the EPA. I also understand that I must furnish suitable containers, be responsible for the laboratory analytical analysis, and sign for the transfer of custody from the EPA designated sampler.

( ) I do not wish to receive a portion of samples taken at the property described above.

This written permission is given by me voluntarily with knowledge of my right to refuse and without threats or promises of any kind.

_____ _____

DATE SIGNATURE, Title



BASE MAP FROM:
U.S. DEPT. OF THE INTERIOR
GEOLOGICAL SURVEY
HOUMA QUADRANGLE
LOUISIANA
7.5 MINUTE SERIES (TOPOGRAPHIC)
1983 SERIES (REV. 1974 AND 1980)
SCALE 1:24,000

WESTON

FIGURE 2

EPA REGION VI
ARCS SITE INSPECTIONS
PRIORITIZATION
SITE AREA MAP

DELTA SHIPYARD
HOUMA, LOUISIANA
CERCLA ID. NO. : LAD058475419

W.O. NO. : 04803-687-022-2140

CONSENT FOR ACCESS TO PROPERTY

Name: Lynn Dean

EPA I.D. No.: LAD058475419
Site Name: Delta Shipyard, Houma, Louisiana

Description of Property: The Delta Shipyard is located at 201 Industrial Boulevard in Houma, Louisiana (see attached site location map).

I hereby consent to officers, employees, and representatives authorized by the United States Environmental Protection Agency (EPA) entering and having continued access to my property for the following purposes:

1. Reviewing and copying documents related to the site;
2. The taking of such soil, water and air samples as may be determined to be necessary;
3. The sampling of any solids or liquids stored or disposed of on property;
4. The drilling of holes and the installation of monitoring wells for subsurface investigation of subsurface contamination.

I realize that these actions are undertaken pursuant to EPA's response and enforcement responsibilities under the Comprehensive Environmental Responsibility, Compensation, and Liability Act, as amended (CERCLA), 42 U.S.C. § 9601 et seq., as well as 40 CFR Part 300.400 Subpart E.

I am the property owner, or a responsible agent of the property owner, and I warrant that I have the authority to enter into this access agreement.

Place a check mark in the appropriate space. Please note that if no selection is made EPA will assume that you do not wish to be provided with a portion of the sample.

(✓) Please provide me with a portion of each sample taken at the property described above. I understand that there will be no charge for the sample portions provided by the EPA. I also understand that I must furnish suitable containers, be responsible for the laboratory analytical analysis, and sign for the transfer of custody from the EPA designated sampler.

( ) I do not wish to receive a portion of samples taken at the property described above.

This written permission is given by me voluntarily with knowledge of my right to refuse and without threats or promises of any kind.

2/13/96
DATE

SIGNATURE, Title MANAGER FOR LYNN DEAN
KEN SERIGNE

APPENDIX B

HEALTH AND SAFETY PLAN

SITE HEALTH AND SAFETY PLAN (HASP)

Prepared by: Joy Ishigo

W.O. Number: 04603-026-031-0300 **Date:** 03/01/96

Project Identification:
Division: South Central Region - Houston
Department/Office: 000536/000910
Site Name: Delta Shipyard
Client: US EPA - ARCS
Work Location Address: 202 Industrial Boulevard
Houma, Louisiana

Site History: (describe briefly)

Site was a cleaning and repairing facility for oil barges and fishing vessels.

Scope of Work: (describe briefly)

Site reconnaissance visit and sampling visit to conduct an ARCS Expanded Site Inspection.

☐ Site visit only; site HASP not necessary. List personnel here and sign off below:

Regulatory Status:

Site regulatory status:

CERCLA/SARA	RCRA	Other Federal Agency
☒ US EPA	☐ US EPA	☐ DOE
☐ State	☐ State	☐ USACE
☐ NPL Site	NRC	☐ Air Force
OSHA	☐ 10 CFR 20	☐ _____
☒ Hazard Communication (Req'd See Attachment "D")		
☒ 1910	☐ 1926	☐ State

☒ Safety Officer Manual (Required to be On Site)

Based on the Hazard Assessment and Regulatory Status, determine the Standard HASP(s) applicable to this project. Indicate below which Standard HASP will be used and append the appropriate pages of this form along with the Standard Plan.

☐ Stack Test	☐ _____
☐ Air Emissions	☐ _____
☐ Asbestos	☐ _____
☐ Industrial Hygiene	☐ _____
☒ Hazardous Material	☐ _____

Review and Approval Documentation:

Reviewed by: DSO/RSO/CHS — DARRYL K. DRENON (Name Print) — (Signature) — Date: 3/4/96

Other — Sandy Hayes (Name Print) — (Signature) — Date: 5/28/96

Approved by: Project Director/ Project Manager — JEFF S. HOEMSER (Name Print) — (Signature) — Date: 3/4/96

Hazard Assessment and Equipment Selection

In accordance with WESTON's Personal Protective Equipment Program and 29 CFR 1910.132 at the site prior to personnel beginning work the SHCS and/or the Site Manager have evaluated conditions and verified that the personal protective equipment selection outlined within this HASP is appropriate for the hazards known or expected to exist. (Refer to Safety Officer Manual Section 2 Personal Protection Program for Guidance)

☑ SHSC ☐ Site Manager — Eric Tate (Name Print) — (Signature) — Date: 3/7/96

Project start date: 29 Feb 1996 End date: 29 Aug 1996	This site HASP must be reissued/reapproved for any activities conducted after: Date: 29 August 1996	Amendment date(s): By: 1. 5/28/96 Sandy Hayes 2. 3. 4. 5.

WESTON REPRESENTATIVES

Organization/Branch	Name/Title	Address	Telephone
WESTON/SCR	Eric Tate Project Team Leader	5599 San Felipe, Suite 700 Houston, TX 77056	(713) 621-1620
WESTON/SCR	Joy Ishigo Assistant Engineer	5599 San Felipe, Suite 700 Houston, TX 77056	(713) 621-1620
WESTON/SCR	Dennis Hayes Associate Geologist	5599 San Felipe, Suite 700 Houston, TX 77056	(713) 621-1620

Roles and Responsibilities:

WESTON SUBCONTRACTORS

Organization/Branch	Name/Title	Address	Telephone
N/A			

Roles and Responsibilities:

SITE SPECIFIC HEALTH AND SAFETY PERSONNEL

The Site Health and Safety Coordinator (SHSC) for activities to be conducted at this site is: Eric Tate

The SHSC has total responsibility for ensuring that the provisions of this Site HASP are adequate and implemented in the field.

Changing field conditions may require decisions to be made concerning adequate protection programs. Therefore, the personnel assigned as SHSCs are experienced and meet the additional training requirements specified by OSHA in 29 CFR 1910.120

Qualifications: At a minimum, the SHSC will be a WESTON-certified Level D SHSC. Training includes: OSHA 40-hour hazardous waste training and current refresher training as applicable, current first-aid, CPR, blood-borne pathogen, dangerous goods shipping, and WESTON SHSC training.

Designated alternates include: Dennis Hayes, Bryan Weise

HEALTH AND SAFETY EVALUATION

Hazard Assessment

Background Review: ☐ Complete ☒ Partial If partial why? Areas of site remained unsampled

Activities Covered Under This Plan:

No.	Task/Subtask	Description	Schedule
1.	Site Reconnaissance	Site walk-through with note taking and *photographs.*	
2.	Soil Sampling	Surface soil sampling from on-site and off-site locations.	
3.	Sediment Sampling	Sediment sampling from on-site and off-site locations.	

Types of Hazards:

☐ Numbers refer to one of the following hazard evaluation forms. Complete hazard evaluation forms for each appropriate hazard class.

Physiochemical [1]

- ☒ Flammable
- ☐ Explosive
- ☐ Corrosive
- ☒ Reactive
- ☐ O_2 Rich
- ☐ O_2 Deficient

Chemically Toxic [1]

- ☒ Inhalation
- ☒ Ingestion
- ☒ Contact
- ☒ Absorbtion
- ☒ Carcinogen
- ☐ Mutagen
- ☐ Teratogen

☒ OSHA 1910.1000 Substance (Air Contaminants)

☒ OSHA Specific Hazard Substance Standard
(Refer to HASP Form 04HASP.894 for Listing.)

Radiation [3]

Ionizing:

- ☐ Internal exposure
- ☐ External exposure

Non-ionizing:

- ☐ UV
- ☐ IR
- ☐ RF
- ☐ MicroW
- ☐ Laser

Biological [2]

- ☐ Etiological Agent
- ☒ Other (Plant, insect, animal)

☒ Physical Hazards [4]

☐ *Construction Activities*

Source/Location of Contaminants and Hazardous Substances

Directly Related to Tasks

- ☒ Air
- ☒ Other Surface
- ☒ Groundwater
- ☒ Soil
- ☒ Surface Water
- ☐ Sanitary Wastewater
- ☐ Process Wastewater
- ☐ Other _____

Indirectly Related to Tasks - Nearby Process(es) That Could Affect Team Members:

- ☐ Client Facility
- ☐ Nearby Non-client Facility

Describe: In accordance with the Scope of Work, a client briefing will not be arranged before the site reconnaissance is performed. Subsequently, a briefing may be held with EPA to identify imminent threats associated with the site, if any.

☐ Client Briefing Arranged

HEALTH AND SAFETY EVALUATION - 1 CHEMICAL HAZARDS

☐ N/A

Chemical Contaminants of Concern

Provide the data requested for chemical contaminants on HASP Form 33HASP.894 or attach data sheets from an acceptable sources such as NIOSH pocket guide, condensed chemical dictionary, ACGIH TLV booklet, etc. List chemical and concentration below and locate data sheets in Appendix A of this HASP.

☒ N/A

Identify hazardous materials used or on-site and attach Material Safety Data Sheets (MSDS) for all reagent type chemicals, solutions, or other identified materials that in normal use in performing tasks related to this project could produce hazardous substances. Ensure that all subcontractors and other parties working nearby are informed of the presence of these chemicals and the location of MSDS's. Obtain from subcontractors and other parties lists of the hazardous materials they use or have on-site and identify location of MSDS's here. List chemicals and quantities below and locate MSDS in Appendix B of this HASP.

Chemical Name		Concentration (if known)		Chemical Name	Quantity
		(mg/kg)			
Benzene	Barium	0.070	20.5		
Ethylbenzene	Beryllium	0.170	0.094		
Xylenes	Cadmium	0.240	0.0049		
Carbazole	Chromium	0.69	0.527		
Chrysene	Lead	5.3	0.632		
Naphthalene	Mercury	11.0	0.0013		
Phenanthrene	Selenium	8.8	0.037		
Pyrene	Zinc	12.0	0.666		
4,4 DDD	Vanadium	0.035	0.0301		
Heptachlorepoxide	Flouoranthene	0.025	13.0		
Hethoxychlor	Fluorene	0.069	5.10		
2-Methylnaphthalene	Indeno(1,2,3-ed)pyrene	47.0	3.0		
Benzo(b)fluoranthene	Arsenic	6.10	0.0297		
Benzo(g,h,i)perylene	Anthracene	2.5			
Dibenz(a,h)anthracene		1.3			
Aluminum		10.9			
Autimony		0.0125			

OSHA SITE SPECIFIC HAZARDOUS SUBSTANCES

The following substances may require specific medical, training, or monitoring based upon concentration or evaluation of risk. See the appropriate citation listed under 29 CFR 1910 or 1926 for additional information.

☐ 1910.1001 Asbestos	☒ 1910.1002 Coal tar pitch volatiles	☐ 1910.1003 4-Nitrobiphenyl	☐ 1910.1004 alpha-Naphthylamine
☐ 1910.1005 [Reserved]	☐ 1910.1006 Methyl chloromethyl ether	☐ 1910.1007 3,3'-Dichlorobenzidine (and its salts).	☐ 1910.1008 bis-Chloromethyl ether
☐ 1910.1009 beta-Naphthylamine	☐ 1910.1010 Benzidine	☐ 1910.1011 4-Aminodiphenyl	☐ 1910.1012 Ethyleneimine
☐ 1910.1013 beta-Propiolactone	☐ 1910.1014 2-Acetylaminofluorene	☐ 1910.1015 4-Dimethylaminoazobenzene	☐ 1910.1016 N-Nitrosodimethylamine
☐ 1910.1017 Vinyl chloride	☒ 1910.1018 Inorganic arsenic	☒ 1910.1025 Lead	☒ 1910.1027 Cadmium
☒ 1910.1028 Benzene	☐ 1910.1029 Coke oven emissions	☐ 1910.1043 Cotton dust	☐ 1910.1044 1,2-dibromo-3-chloropropane
☐ 1910.1045 Acrylonitrile	☐ 1910.1047 Ethylene oxide	☐ 1910.1048 Formaldehyde	☐ 1910.1050 Methylenedianiline

HEALTH AND SAFETY EVALUATION - 2 BIOLOGICAL HAZARDS OF CONCERN

☒ **Poisonous Plants** (FLD 43)

Location/Task No(s).: All

Source: ☐ Known ☒ Suspect

Route of Exposure: ☐ Inhalation ☐ Ingestion ☒ Contact ☐ Direct Penetration

Team Member(s) Allergic: ☐ Yes ☒ No

Immunization required: ☐ Yes ☒ No

☒ **Insects** (FLD 43)

Location/Task No(s).: All

Source: ☐ Known ☒ Suspect

Route of Exposure: ☐ Inhalation ☐ Ingestion ☐ Contact ☒ Direct Penetration

Team Member(s) Allergic: ☐ Yes ☒ No

Immunization required: ☐ Yes ☒ No

☒ **Snakes, Reptiles** (FLD 43)

Location/Task No(s).: All

Source: ☐ Known ☒ Suspect

Route of Exposure: ☐ Inhalation ☐ Ingestion ☐ Contact ☒ Direct Penetration

Team Member(s) Allergic: ☐ Yes ☒ No

Immunization required: ☐ Yes ☒ No

☒ **Animals** (FLD 43)

Location/Task No(s).: All

Source: ☐ Known ☐ Suspect

Route of Exposure: ☐ Inhalation ☐ Ingestion ☐ Contact ☒ Direct Penetration

Team Member(s) Allergic: ☐ Yes ☒ No

Immunization required: ☐ Yes ☒ No

FLD 43 — WESTON Biohazard Field Operating Procedures: Att. OP ☒

☐ **Sewage**

Location/Task No(s).:

Source: ☐ Known ☐ Suspect

Route of Exposure: ☐ Inhalation ☐ Ingestion ☐ Contact ☐ Direct Penetration

Team Member(s) Allergic: ☐ Yes ☐ No

Immunization required: ☐ Yes ☐ No

Tetanus Vaccination within Past 7 yrs: ☐ Yes ☐ No
(see Note #1 below)

☐ **Etiologic Agents (List)**

Location/Task No(s).:

Source: ☐ Known ☐ Suspect

Route of Exposure: ☐ Inhalation ☐ Ingestion ☐ Contact ☐ Direct Penetration

Team Member(s) Allergic: ☐ Yes ☐ No

Immunization required: ☐ Yes ☐ No

FLD 44 — WESTON Bloodborne Pathogens Exposure Control Plan - First Aid Procedures: Att. OP ☒

FLD 45 — WESTON Bloodborne Pathogens Exposure Control Plan – Working with Infectious Waste: Att. OP ☐

Note #1: A tetanus injection is recommended every 10 years for employees with "normal exposure risks." However, if employees have frequent potential for exposure at "higher risk," as working with raw sewage, then a frequency of 7 years is recommended.

HEALTH AND SAFETY EVALUATION – 3 RADIATION HAZARDS OF CONCERN

NONIONIZING RADIATION

Task #	Type of Nonionizing Radiation	Source Onsite	TLV/PEL	Wavelength Range	Control Measures	Monitoring Instrument		
	Ultraviolet							
	Infrared							
	Radio Frequency							
	Microwave							
	Laser							

IONIZING RADIATION

				DAC (μCi/mL)				
Task #	Radionuclide	Major Radiations	Radioactive Half-Life (Years)	D	W	Y	Surface Contamination Limit	Monitoring Instrument

HEALTH AND SAFETY EVALUATION - 4 PHYSICAL HAZARDS OF CONCERN			
Phy.Haz.Cond.	**Physical Hazard**	**Att.OP**	**Weston OP Titles**
Loud noise	Hearing loss/disruption of communication		FLD01 - Noise Protection
Inclement weather	Rain/humidity/cold/ice/snow/lightning	X	FLD02 - Inclement Weather
Steam heat stress	Burns/displaced oxygen/wet working surfaces		FLD03 - Hot Process - Steam
Heat/Stress	Burns/hot surfaces/low pressure steam		FLD04 - Hot Process - LT3
Ambient heat stress	Heat rash/cramps/exhaustion/heat stroke	X	FLD05 - Heat Stress Prevention/Monitoring
Cold Stress	Hypothermia/frostbite		FLD06 - Cold Stress
Cold/wet	Trench/paddy/immersion foot/edema		FLD07 - Wet Feet
Confined spaces	Falls/burns/drowning/engulfment/electrocution		FLD08 - Confined Space Entry
Explosive vapors	Thermal burns/impaction/dismemberment		FLD09 - Hot Work
Improper lifting	Back strain/abdomen/arm/leg muscle/joint injury	X	FLD10 - Manual Lifting/Handling Heavy Objects
Uneven Surfaces	Vehicle accidents/slips/trips/falls	X	FLD11 - Rough Terrain
Poor housekeeping	Slips/trips/falls/punctures/cuts/fires	X	FLD12 - Housekeeping
Structural integrity	Crushing/overhead hazards/compromised floors		FLD13 - Structural Integrity
Hostile persons	Bodily injury		FLD14 - Site Security
Remote Area	Slips/trips/falls/back strain/communication	X	FLD15 - Remote Area
Improper Cyl.Handling	Mechanical injury/fire/explosion/suffocation	X	FLD16 - Pressure Systems - Compressed Gases
Water Hazards	Poor visibility/entanglement/drowning/cold stress		FLD17 - Diving
Water Hazards	Drowning/heat/cold stress/hypothermia/falls	X	FLD18 - Operation and Use of Boats
Water Hazards	Drowning/frostbite/hypothermia/falls/electrocution	X	FLD19 - Working Over Water
Vehicle Hazards	Struck by vehicle/collision		FLD20 - Traffic
Explosions	Explosion/fire/thermal burns		FLD21 - Explosives
Moving mechanical parts	Crushing/pinch points/overhead hazards		FLD22 - Heavy Equipment Operation
Moving mech.parts	Overhead hazard/electrocution		FLD23 - Cranes/Lifting Equipment Operation
Working at elevation	Overhead hazards/falls/electrocution		FLD24 - Aerial Lifts/Manlifts
Working at elevation	Overhead hazard/falls/electrocution		FLD25 - Working at Elevation
Working at elevation	Overhead hazard/falls/electrocution/slips		FLD26 - Ladders
Working at elevation	Slips/trips/falls/overhead hazards		FLD27 - Scaffolding
Trench Cave-in	Crushing/falling/overhead hazards/suffocation		FLD28 - Excavating/Trenching
Improper material handling	Back injury/crushing from load shifts		FLD29 - Materials Handling
Physiochemical	Explosions/fires from oxidizing, flam./corr.material	X	FLD30 - Hazardous Materials Use/Storage
Physiochemical	Fire and explosion		FLD31 - Fire Prevention/Response Plan Required
Physiochemical	Fire	X	FLD32 - Fire Extinguishers Required
Structural integrity	Overhead/electrocution/slips/trips/falls/fire		FLD33 - Demolition
Electrical	Electrocution/shock/thermal burns		FLD34 - Utilities
Electrical	Electrocution/shock/thermal burns		FLD35 - Electrical Safety
Burns/Fires	Heat Stress/Fires/Burns		FLD36 - Welding/Cutting/Burning
Impact/thermal	Thermal burn/high pressure impaction/heat stress		FLD37 - High Pressure Washers
Impaction/electrical	Smashing body parts/pinching/cuts/electrocution	X	FLD38 - Hand and Power Tools
Poor visibility	Slips/trips/falls		FLD39 - Illumination
Fire/Explosion	Burns/impaction		FLD40 - Storage Tank
Communications	Disruption of Communications		FLD41 - Std. Hand/Emergency Signals
Energy/Release	Unexpected release of energy		FLD42 - Lockout/Tagout
Drilling hazards	Electrocution/overhead hazards/pinch points		2.5 - Drilling Safety Guide

TASK-BY-TASK RISK ASSESSMENT
(Complete One Sheet for Each Task)

TASK DESCRIPTION

1. Site Reconnaissance

EQUIPMENT REQUIRED/USED
(Be specific, e.g., hand tools, heavy equipment, instruments, PPE)

Steel-toed boots
Coveralls
Drager tubes
OVA

POTENTIAL HAZARDS/RISKS

CHEMICAL

☒ **Hazard Present** **Risk Level:** ☐ H ☐ M ☒ L

What Justifies Risk Level? Low risk because no intrusive activities will be performed.

PHYSICAL

☒ **Hazard Present** **Risk Level:** ☐ H ☐ M ☒ L

What Justifies Risk Level? Low risk because no intrusive activities will be performed.

BIOLOGICAL

☒ **Hazard Present** **Risk Level:** ☐ H ☒ M ☐ L

What Justifies Risk Level? *Site located next to bayou (snakes, spiders, poison ivy).*

RADIOLOGICAL

☐ **Hazard Present** **Risk Level:** ☐ H ☐ M ☒ L

What Justifies Risk Level? No known sources.

LEVELS OF PROTECTION/JUSTIFICATION

Level D: Initial level of protection will be Level D because no known air pathways are suspected in the breathing zone. Sampling team will monitor area using an OVA (breathing zone) to determine if upgrading to a higher level of protection is needed.

SAFETY PROCEDURES REQUIRED AND/OR FIELD OPS UTILIZED

Follow standard operating procedures as specified in the WESTON SHSC manual.

TASK-BY-TASK RISK ASSESSMENT
(Complete One Sheet for Each Task)

TASK DESCRIPTION

2. Site Sampling, Soil Sampling: Members of the project team will collect soil samples from on-site and off-site locations.

EQUIPMENT REQUIRED/USED
(Be specific, e.g., hand tools, heavy equipment, instruments, PPE)

Steel-toed boots	Disposable plastic scoops
Coveralls (Tyvek)	Hand augers
OVA	Drager tubes
Booties	Gloves (nitrile and latex)

POTENTIAL HAZARDS/RISKS

CHEMICAL

☒ Hazard Present Risk Level: ☐ H ☒ M ☐ L

What Justifies Risk Level? Potential for exposure to chemical hazards by inhalation and contact during intrusive tasks. Risk minimized by use of air monitoring device.

PHYSICAL

☒ Hazard Present Risk Level: ☐ H ☒ M ☐ L

What Justifies Risk Level? Rough terrain.

BIOLOGICAL

☒ Hazard Present Risk Level: ☐ H ☒ M ☐ L

What Justifies Risk Level? *The site is adjacent to a large bayou with lots of high weeds (snakes, spiders, poison ivy, etc.)*

RADIOLOGICAL

☐ Hazard Present Risk Level: ☐ H ☐ M ☒ L

What Justifies Risk Level? No known sources.

LEVELS OF PROTECTION/JUSTIFICATION

Level D: Initial level of protection will be Level D because no known air pathways are suspected in the breathing zone. Sampling team will monitor area using an OVA (breathing zone) to determine if upgrading to a higher level of protection is needed.

SAFETY PROCEDURES REQUIRED AND/OR FIELD OPS UTILIZED

Follow standard operating procedures as specified in the WESTON SHSC manual.

TASK-BY-TASK RISK ASSESSMENT
(Complete One Sheet for Each Task)

TASK DESCRIPTION

3. Site Sampling, Sediment Sampling: Members of the project team will collect sediment samples from on-site and off-site locations.

EQUIPMENT REQUIRED/USED
(Be specific, e.g., hand tools, heavy equipment, instruments, PPE)

Steel-toed boots	Disposable plastic scoops
Coveralls/Tyvek	Hand augers
OVA	Drager tubes
Gloves (nitriles and latex)	Boat
Dredge sampler	Booties

POTENTIAL HAZARDS/RISKS

CHEMICAL

☒ Hazard Present Risk Level: ☐ H ☒ M ☐ L

What Justifies Risk Level? Potential for exposure to chemical hazards by inhalation and contact during intrusive tasks. Risk minimized by use of air monitoring device.

PHYSICAL

☒ Hazard Present Risk Level: ☐ H ☒ M ☐ L

What Justifies Risk Level? Rough terrain.

BIOLOGICAL

☒ Hazard Present Risk Level: ☐ H ☒ M ☐ L

What Justifies Risk Level? Site located next to a large bayou with lots of high weeds (snakes, spiders, poison ivy).

RADIOLOGICAL

☐ Hazard Present Risk Level: ☐ H ☐ M ☒ L

What Justifies Risk Level? No known sources.

LEVELS OF PROTECTION/JUSTIFICATION

Level D: Initial level of protection will be Level D because no known air pathways are suspected in the breathing zone. Sampling team will monitor area using an OVA (breathing zone) to determine if upgrading to a higher level of protection is needed.

SAFETY PROCEDURES REQUIRED AND/OR FIELD OPS UTILIZED

Follow standard operating procedures as specified in the WESTON SHSC manual.

PERSONNEL PROTECTION PLAN

Engineering Controls
Describe Engineering Controls used as part of Personnel Protection Plan:

Task(s) All

Soils may be moistened to suppress dust generation if conditions are dry, and this is thought to be necessary by the SHSC.

Administrative Controls
Describe Administrative controls used as part of Personnel Protection Plan:

Task(s) All

Follow the HASP and SOPs. An initial safety meeting will be held at the site before work starts and safety meetings will be held each morning as needed. This will be done to keep all team members current on their knowledge of safety concerns at the site.

Personnel Protective Equipment
Action Levels for Changing Levels of Protection. Define Action Levels for up or down grade for each task:

Task(s) All

Mini-RAM action level is determined as follows: PAH PELS based on coal tar pitch volatiles; 4,4' DDD based on DDD; Xylenes based on σ-Xylene. Particulate action level applies to Tasks 1, 2. Volatile action levels applies to Tasks 1, 2, 3.

(on next pages)

Description of Levels of Protection

Level D		Level D Modified
Task(s): 2,3		**Task(s):**
☐ Head		☐ Head
☐ Eye and Face		☐ Eye and Face
☐ Hearing		☐ Hearing
☐ Arms and Legs Only		☐ Arms and Legs Only
☒ Appropriate Work Uniform	Coveralls/Tyvek	☐ Whole Body
☒ Hand - Gloves	Latex (Task 2, 3)	☐ Apron
☒ Foot - Safety Boots	Steel-toed	☐ Hand - Gloves
☐ Fall Protection		☐ Gloves
☒ Flotation	(Task 3)	☐ Gloves
☐ Other	Boot covers	☐ Foot - Safety Boots
		☐ Boots
		☐ Boots

Description of Levels of Protection

Level C		Level B
Task(s):	2,3	Task(s):
☐ Head		☐ Head
☐ Eye and Face		☐ Eye and Face
☐ Hearing		☐ Hearing
☐ *Arms and Legs Only*		☐ *Arms and Legs Only*
☒ Whole Body	Tyvek	☐ Whole Body
☐ Apron		☐ Apron
☒ Hand - Gloves		☐ Hand - Gloves
☒ Gloves	Inner - latex	☐ Gloves
☒ Gloves	Outer - nitriles	☐ Gloves
☒ Foot - Boots	Safety boots	☐ Foot - Boots
☒ Boots	Boot covers	☐ Boots
☐ Boots		☐ Boots
☐ Half Face		☐ SAR - Airline
☐ Cart./Canister		☐ SCBA
☒ Full Face		☐ Comb. Airline/SCBA
☒ Cart./Canister	GMAF	☐ Cascade System
☐ PAPR		☐ *Compressor*
☐ Cart./Canister		☐ Fall Protection
☐ Type C		☐ Flotation
☐ Fall Protection		☐ Other
☒ Flotation	Task 3	
☐ Other		

S[illegible]OR PROJECT HAZARD MONITORING P[illegible]RAM

Direct Reading Air Monitoring Instruments

Instrument Selection and Initial Check Record

Reporting Format: ☒ Field Notebook ☐ Field Data Sheets ☐ Air Monitoring Log ☐ Trip Report ☐ Other

Instrument	Task No.(s)	Number Required	Number Received	Checked Upon Receipt	Comment	Initials
☐ CGI				☐		
☐ O_2				☐		
☐ CGI/O_2				☐		
☐ CGI/O_2/tox-PPM, H_2S,H_2S/CO				☐		
☐ RAD-GM				☐		
☐ NaI				☐		
☐ ZnS				☐		
☐ Other _____				☐		
☐ PID				☐		
☐ HNU 10.2				☐		
☐ HNU 11.7				☐		
☐ Photovac, TMA				☐		
☐ OVM				☐		
☐ Other _____				☐		
☒ FID	All			☐		
☒ FOX 128				☐		
☐ Heath, AID, Other _____				☐		
☒ RAM, Other _____	1,2			☐		
☐ Monotox				☐		
☐ H_2S				☐		
☐ COCL				☐		
☐ SO_2				☐		
☐ HCN				☐		
☐ Other _____				☐		
☐ Bio-Aerosol Monitor				☐		
☐ Detector Tubes				☐		
☒ Pump - MSA, Dräeger, Sensidyne				☐		
☒ Tubes/type: Benzene 0.5/A	All			☐		
☒ Tubes/type: Napthalene	All			☐		
☐ Other				☐		

SITE OR PROJECT HAZARD MONITORING PROGRAM

Direct Reading Air Monitoring Instruments Calibration Record

Instrument, Mfg., Model, Equip. ID No.	Date	Time	Calib. Material	Calib. Method Mfg.'s	Other	Initial Setting and Reading	Final Setting and Reading	Calibrator's Initials

SITE AIR MONITORING PROGRAM

Direct Reading Air Monitoring Instruments

Air Monitoring Instrument: Drager tubes

Air Monitoring Frequency:

- ☐ Periodically:
- ☐ Periodically:
- ☒ Continuously:
- ☐ Other:

Monitoring Locations

- ☒ Upwind/downwind of site activities
- ☒ Near residents, etc.
- ☐ Key site activity locations:
  - ☒ Decon area
  - ☒ Staging area
  - ☐ Excavation area
  - ☐ Field lab area
  - ☒ Storage tanks
  - ☒ Lagoons
  - ☒ Drums
- ☐ Fixed stations
- ☐ Other:

Air Monitoring Instrument: OVA

Air Monitoring Frequency:

- ☐ Periodically:
- ☐ Periodically:
- ☒ Continuously:
- ☐ Other:

Monitoring Locations

- ☒ Upwind/downwind of site activities
- ☒ Near residents, etc.
- ☐ Key site activity locations:
  - ☒ Decon area
  - ☒ Staging area
  - ☐ Excavation area
  - ☐ Field lab area
  - ☒ Storage tanks
  - ☒ Lagoons
  - ☒ Drums
- ☐ Fixed stations
- ☐ Other:

DELTA SHIPYARD
MINI-RAM ACTION LEVEL CALCULATIONS

CONTAINMENT	PEL (MG/M³)	SOIL CONC. (MG/KG)	CONC/EL
Z-Methyluaphthalene	0.1	47	470
Anthracene	0.1	1.3	13
Benzo(a)anthracene	0.1	6	60
Benzo(a)pyrene	0.1	4.1	41
Benzo(b)fluorothene	0.1	6.1	61
Benzo(g,h,i)perylene	0.1	2.5	25
Carbazole	0.1	0.69	6.9
Chrysene	0.1	5.3	53
Dibenz(ajh)authracene	0.1	1.3	13
Fluoanthene	0.1	13	130
Fluorene	0.1	5.1	51
Indeno(1,2,3,-cd)pyrene	0.1	3.0	30
Phenanthene	0.1	8.8	88
Pyrene	0.2	12	60
4,4 DDD	0.5	0.035	0.07
Heptachlorexpoxide	0.5	0.025	0.05
Methoxychlor	10	0.069	0.0069
Aluminum	5	10,900	2180
Antimony	0.5	12.5	25
Arsenic	0.002	24.8	12,400
Barium	0.5	20,500	41,000
Beryllium	0.002	0.94	470
Cadmium	0.005	4.9	980
Chromium	0.5	527	1,054
Lead	0.05	632	12,640
Mercury	0.05	1.3	26
Selenium	0.2	0.37	1.85
Vanadium	0.05	30.1	602
			72,481

$$Elmix = \frac{10^6\ \mu mg/kg}{(72481)(2)} = 6.9\ \frac{mg}{m^3} > 2.5\ \frac{mg}{m^3}\ (nuisance\ dust)\ respirable\ fraction$$

$$Action\ Level = 2.5\ \frac{mg}{m^3}$$

DELTA SHIPYARD EPA ARCS
HASP PPP-PPE

ORGANIC GASES + VAPORS	PEL (PPM)	R%	AL	RANK
Benzene	0.1	185	0.9025	1
Ethylbenzene	100	111	55.5	4
Xylenes	100	92	46	3
Naphthalene	10	48	5	2

Benzene may be too small to read on the OVA. Naphthalene is also a small action level. Thus, if these two chemicals can be ruled out, the next action level is Xylenes.

$$\frac{100 \times (0.92)}{2} = 46$$

0-1 Level D
1-46 Level D provided that Drager Tubes reading for benzene TS below 0.1ppm : Naphthalene is below 5ppm.
>46 Units stop work/Upgrade to Level C

SITE AIR MONITORING PROGRAM

Action Levels

These Action Levels, if not defined by regulation, are some percent (usually 50%) of the applicable PEL/REL/TLV. That number must also be adjusted to account for instrument response factors.

	Tasks	Action Level		Action
☐ **Explosive atmosphere**		Ambient Air Concentration	Confined Space Concentration	
		<10% LEL	0 to 1% LEL	Work may continue. Consider toxicity potential.
		10 to 25% LEL	1 to 10% LEL	Work may continue. Increase monitoring frequency.
		>25% LEL	>10% LEL	Work must stop. Ventilate area before returning.
☐ **Oxygen**		Ambient Air Concentration	Confined Space Concentration	
		<19.5% O_2	<19.5% O_2	Leave Area. Re-enter only with self-contained breathing apparatus.
		19.5% to 25% O2	19.5% to 23.5% O_2	Work may continue. Investigate changes from 21%.
		>25% O_2	>23.5% O_2	Work must stop. Ventilate area before returning.
☐ **Radiation**		< 3 times background		Continue Work
		3 Times Background to < 1 mR/hour		Radiation above background levels (normally 0.01-0.02 mR/hr)g signifies possible source(s) radiation present. Continue investigation with caution. Perform thorough monitoring. Consult with a Health Physicist.
		> 1 mrem/hour		*Potential radiation* hazard. Evacuate site. Continue investigation only upon the advice of Health Physicist.
☒ **Organic gases and vapors**	All	Task 2: 0-1 unit		Can't work Level D
		1-46 units		Level D provided Drager tubes rule out Benzene and Naphthalene
		> 46 units		Stop work/Upgrade to Level C
☒ **Inorganic gases, vapors and particulates**	All	> 2.5 mg/m^3 sustained in breathing zone		Stop work

SITE AIR MONITORING PROGRAM

Ambient Air Sampling

Check situations which will require or action levels which will apply to deciding to institute or increase scope of planned air sampling.

☒ No air sampling is required on this site.

☐ An air sampling plan is incorporated in this HASP.

Meteorological Conditions

☐ Dry weather for ____ days

☐ *Ambient temperature above* ____ °F

☐ Wind increasing potential of more contaminant dispersion in or migration out of controlled area.

Activities which will require instituting or increasing scope of air sampling:

☐ *Major spills*

☐ New site activity resulting in potential presence of new chemical hazards.

☐ Site activity increases airborne contaminants possibilities.

☐ *Air sampling documentation required for:*
- ☐ Downgrading from stipulated level of protection
- ☐ Documenting no migration of contaminants off-site through air

Applicable Action Levels for instituting Air Sampling:

☐ Visible vapor/gas clouds or vapor levels, or

☐ Visible dust or particulate levels measured with Direct Reading Instrument, two-three times background or above action level, sustained over 10-15 minute period.

The following requirements apply to air sampling:

Sampling Matrix/Air Interface - Monitor matrix/air interface and breathing zone periodically with DRI. If vapor levels > 2-3 times background, monitor continuously. Follow No. 4.

Container Opening - Monitor opening and breathing zone periodically with DRI. If vapor levels > 2-3 times background, monitor opening and breathing zone continuously. Follow No. 4.

Excavation/Drilling/Intrusive Work - Monitor at ground level and breathing zone periodically with DRI. If vapor levels > 2-3 times background, monitor opening and breathing zone continuously. Follow No. 4.

Breathing Zone - Ensure level of protection specified in HASP is being used. Consult HASP or Corporate Health and Safety relative to instituting personnel, area, or perimeter sampling.

☐ Other

SITE AIR MONITORING PROGRAM

Sample Location

	Locations	Substances Sampled For
☐ Ambient background		
☐ Personal samples, on-site		
☐ Personal samples, off-site		
☐ Fixed, on-site samples		
☐ Fixed, off-site samples		
☐ Mobile off-site samples		
☐ Mobile on-site samples		
☐ Background sample stations		

SITE AIR MONITORING PROGRAM

Air Sampling

Personal Sampling Pumps - Gilian, SKC, MSA No. ___

Sampling Media - Sorbent Tubes

Task(s)	Location	Duration	Frequency	Type	Analysis Method

Sampling Media - Filter

Sampling Media - Impinger

Sampling Media - Air Bag

SITE AIR MONITORING PROGRAM

Air Sampling

Hi-Volume Pumps - Gilian, SKC, MSA

Sampling Media - Filter

Task(s)	Location	Duration	Frequency	Type	Analysis Method

Portable Gas Chromatograph Task(s): Type:

Portable GC Analytical Plan:

Passive Dosimeters

	Task(s)	Type	Location	Frequency	Duration
☐ Organic Vapor					
☐ Mercury Vapor					
☐ Paper Color Change					
☐ TLD					
☐ Film Badge					
☐ Liquid Media					

Wipe Sampling

Wipe Sampling Plan:

SITE AIR MONITORING PROGRAM

Physical Hazard and Miscellaneous Monitors and Detectors

	Task(s)	Calibration Required?/Method	Location	Frequency
☐ Sound Level Meter		☐		
☐ Noise Dosimeter(s)		☐		
☐ Octave Band Analyzer		☐		
☐ Electric Circ. Detector		☐		
☐ Thermometer		☐		
☐ Wind Speed Indicator		☐		
☐ Barometer		☐		
☐ Psychrometer		☐		
☐ Infrared Thermometer		☐		
☐ Microwave Detector		☐		
☐ pH Meter		☐		

Indicator Kits

	Task(s)	Location	Frequency
☐ pH Paper			
☐ Peroxide Paper			
☐ Chlor-N-Oil Kit			
☐ Hazard Categorizing Kit			
☐ Asbestos Test Kit			

SITE AIR MONITORING PROGRAM

Work Location Instrument Readings

Location:

% LEL	% O_2	PID (units)	FID (units)	Aerosol Monitor (mg/m^3)	GM: Shield Probe/ Thin Window		NaI (uR/hr)	ZnS (cpm)
					mR/hr	cpm		

Monitox (ppm)				Detector Tube(s)				

Sound Levels (dBA)		Illumination	pH	Other	Other	Other	Other	Other

Location:

% LEL	% O_2	PID (units)	FID (units)	Aerosol Monitor (mg/m^3)	GM: Shield Probe/ Thin Window		NaI (uR/hr)	ZnS (cpm)
					mR/hr	cpm		

Monitox (ppm)				Detector Tube(s)				

Sound Levels (dBA)		Illumination	pH	Other	Other	Other	Other	Other

CONTINGENCIES

Emergency Contacts and Phone Numbers

Agency	Contact	Phone Number
Local Medical Emergency Facility (LMF)		(504)873-2200
WESTON Medical Emergency Contact	EMR - Dr. Elayne Theriault	1-800-229-3674
WESTON Health and Safety	Corporate Health and Safety	(505)884-5050
WESTON Health and Safety	SCR Health and Safety - Darryl Drenon	Pager:(800)409-2261 or (713)621-1620
Fire Department		911
Police Department		911
On-site Coordinator		
Site Telephone		
Nearest Telephone		

Local Medical Emergency Facility(s)

Name of Hospital: Chambert Medical Center

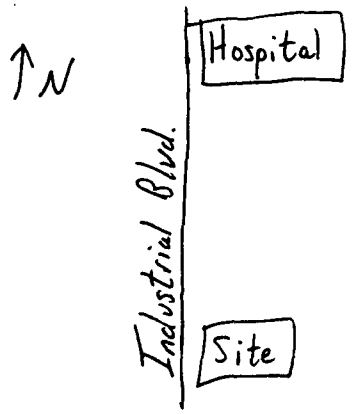
Address: 1978 Industrial Blvd.		**Phone No.:** (504)873-2200
Name of Contact: Bobby Cupp		**Phone No.:**
Type of Service: ☐ Physical trauma only ☐ Chemical exposure only ☒ Physical trauma and chemical exposure ☒ Available 24 hours	**Route to Hospital (written detail):** Site and hospital lie on Industrial Blvd. The hospital is 16 blocks north of the site.	**Travel time from site:** 10 minutes **Distance to hospital:** 16 blocks **Name/No. of 24-hr Ambulance Service:** Acadian 1-800-259-1111

Secondary or Specialty Service Provider

Name of Hospital:

Address:		**Phone No.:**
Name of Contact:		**Phone No.:**
Type of Service: ☐ Physical trauma only ☐ Chemical exposure only ☐ Physical trauma and chemical exposure ☐ Available 24 hours	**Route to Hospital (written detail):**	**Travel time from site:** **Distance to hospital:** **Name/No. of 24-hr Ambulance Service:**

Figure 1. Route to Hospital
(Draw map to hospital here if space permits or attach on separate sheet.)



CONTINGENCIES

Response Plans

<table>
<tr><td rowspan="3">Medical - General

Provide First Aid as trained, assess and determine need for further medical assistance, Transport or arrange for transport after appropriate decontamination</td><td>First Aid Kit:

Condensed</td><td>Type

20 man BBP</td><td>Location

WESTON vehicle</td><td>Special First Aid Procedures:
Cyanides on site
☐ Yes ☒ No.
If yes, contact LMF. Do they have antidote kit?
☐ Yes ☐ No</td></tr>
<tr><td>Eyewash required
☒ Yes ☐ No</td><td>Type</td><td>Location

First-aid kit in van</td><td>HF on site
☐ Yes ☒ No.
If yes, need neutralizing ointment for First Aid kit. Contact LMF.</td></tr>
<tr><td>Shower required
☐ Yes ☒ No</td><td>Type</td><td>Location</td><td></td></tr>
<tr><td colspan="2">Plan for Response to Spill/Release</td><td colspan="2">Plan for Response to Fire/Explosion</td><td>Fire Extinguishers</td></tr>
<tr><td>In the event of a spill or release, ensure safety, assess situation and perform containment and control measures as appropriate:</td><td>a. Clean up per MSDS if small or; Sound Alarm, call for assistance, Notify Emergency Coordinator
b. Evacuate to pre-determined safe place
c. Account for personnel
d. Determine if Team can respond safely
e. Mobilize per Site Spill Response Plan</td><td>In the event of a fire or explosion, ensure personal safety, assess situation and perform containment and control measures as appropriate:</td><td>a. Sound Alarm and call assistance, Notify Emergency Coordinator
b. Evacuate to predeter-mined safe place
c. Account for personnel
d. Use fire extinguisher, only if safe and trained
e. Standby to inform Emergency responders of materials and conditions</td><td>Type/Location

ABC in van</td></tr>
<tr><td>Description of Spill Response Gear

N/A</td><td>Location</td><td colspan="2">Description (Other Fire Response Equipment)</td><td>Location</td></tr>
<tr><td colspan="5">Plan to Response to Security Problems</td></tr>
</table>

DECONTAMINATION PLAN

Personnel Decontamination

Consistent with the levels of protection required, step-by-step procedures for personnel decontamination for each Level of Protection are attached.

Levels of Protection Required for Decontamination Personnel

The levels of protection required for personnel assisting with decontamination will be:

☐ Level B ☐ Level C ☒ Level D

Modifications include:

Disposition of Decontamination Wastes

Provide a description of waste disposition including identification of storage area, hauler, and final disposal site, if applicable:

Fluids generated from decon of survey equipment (i.e. hand augers) will be collected in 5 gallon buckets. Fluid will be disposed of on-site at respective sampling areas.

Equipment and PPE will be sprayed off in place with water from spray bottles.

Equipment Decontamination

A procedure for decontamination steps required for non-sampling equipment and heavy machinery follows:

Nonsampling equipment, such as monitoring equipments, will not be exposed to sources of contamination. They will be cleaned with a damp towel or by other appropriate means. There will be no heavy machinery associated with the project other than a van and a car. Vehicles will not be driven into areas of known or suspected contamination.

Sampling Equipment Decontamination

Sampling equipment will be decontaminated in accordance with the following procedure:

Only dedicated sampling equipment will be used and will be disposed of in a trash bag.

LEVEL D/MODIFIED LEVEL D DECONTAMINATION PLAN

Check indicated functions or add steps as necessary:

Function	Description of Process, Solution, and Container
☒ Segregated equipment drop	Put sampling equipment in bag
☐ Boot cover and glove wash	
☐ Boot cover and glove rinse	
☐ Tape removal - outer glove and boot	
☒ Boot cover removal	Double bag for disposal
☒ Outer glove removal	Double bag for disposal
HOTLINE	
☐ Suit/safety boot wash	
☐ Suit/boot/glove rinse	
☐ Safety boot removal	
☒ Suit removal	If soiled, bag coveralls for laundry
☐ Inner glove wash	
☐ Inner glove rinse	
☒ Inner glove removal	Double bag for disposal
☐ Inner clothing removal	
CRC/SAFE ZONE BOUNDARY	
☒ Field wash	Wash hands before leaving site
☐ Redress	

Disposal Plan, End of Day:

All PPE will be sealed in bags, placed in labelled 55-gallon drums, and staged in disposal area.

Disposal Plan, End of Week:

Same as daily plan.

Disposal Plan, End of Project:

The disposal procedures will depend on sample analysis.

LEVEL C DECONTAMINATION PLAN

Check indicated functions or add steps as necessary:

Function	*Description of Process, Solution, and Container*
☒ Segregated equipment drop	Put sampling equipment in bag
☐ Boot cover and glove wash	
☐ Boot cover and glove rinse	
☒ Tape removal - outer glove and boot	Double bag for disposal
☒ Boot cover removal	*Double bag for disposal*
☒ Outer glove removal	Double bag for disposal
HOTLINE	
☐ Suit/safety boot wash	
☐ Suit/boot/glove rinse	
☐ Safety boot removal	
☒ Suit removal	Double bag for disposal
☐ Inner glove wash	
☐ Inner glove rinse	
☐ Face piece removal	
☒ Inner glove removal	*Double bag for disposal*
☐ Inner clothing removal	
CRC/SAFE ZONE BOUNDARY	
☒ Field wash	Wash hands and face before leaving site
☐ Redress	

Disposal Plan, End of Day:

All PPE will be sealed in bags, labelled 55-gallon drums, and staged in disposal area.

Disposal Plan, End of Week:

Same as daily plan.

Disposal Plan, End of Project:

The disposal procedures will depend on sample analysis.

LEVEL B DECONTAMINATION PLAN

Check indicated functions or add steps as necessary:

Function	Description of Process, Solution, and Container
☐ Segregated equipment drop	
☐ Boot cover and glove wash	
☐ Boot cover and glove rinse	
☐ Tape removal - outer glove and boot	
☐ Boot cover removal	
☐ Outer glove removal	
HOTLINE	
☐ Suit/safety boot wash	
☐ Suit/SCBA/*boot/glove rinse*	
☐ Safety boot removal	
☐ Remove SCBA backpack w/o disconnecting	
☐ Splash suit removal	
☐ Inner glove wash	
☐ Inner glove rinse	
☐ SCBA disconnect and face piece removal	
☐ *Inner glove removal*	
☐ Inner clothing removal	
CRC/SAFE ZONE BOUNDARY	
☐ Field wash	
☐ Redress	

Disposal Plan, End of Day:

Disposal Plan, End of Week:

Disposal Plan, End of Project:

SITE PERSONNEL AND CERTIFICATION STATUS

WESTON

Name: Eric Tate **Title:** Project Team Leader **Task(s):** All **Certification Level or Description:** D-S, B-T ☒ Medical Current ☒ Training Current ☒ Fit Test Current (Qual.) ☐ Fit Test Current (Quant.)	**Name:** Joy Ishigo **Title:** Engineer **Task(s):** All **Certification Level or Description:** B-T ☒ Medical Current ☒ Training Current ☒ Fit Test Current (Qual.) ☐ Fit Test Current (Quant.)
Name: Diane Williams **Title:** Geologist **Task(s):** 2 **Certification Level or Description:** D-S, B-T ☒ Medical Current ☒ Training Current ☒ Fit Test Current (Qual.) ☐ Fit Test Current (Quant.)	**Name:** Brian Weise **Title:** Technician **Task(s):** 2 **Certification Level or Description:** D-S, B-T ☒ Medical Current ☒ Training Current ☒ Fit Test Current (Qual.) ☐ Fit Test Current (Quant.)
Name: Pam Quackenbush **Title:** Engineer **Task(s):** 2 **Certification Level or Description:** D-S, B-T ☒ Medical Current ☒ Training Current ☒ Fit Test Current (Qual.) ☐ Fit Test Current (Quant.)	**Name:** Greg Braddy **Title:** Geologist **Task(s):** **Certification Level or Description:** C-S, B-T ☒ Medical Current ☒ Training Current ☒ Fit Test Current (Qual.) ☐ Fit Test Current (Quant.)
Name: **Title:** **Task(s):** **Certification Level or Description:** ☐ Medical Current ☐ Training Current ☐ Fit Test Current (Qual.) ☐ Fit Test Current (Quant.)	**Name:** **Title:** **Task(s):** **Certification Level or Description:** ☐ Medical Current ☐ Training Current ☐ Fit Test Current (Qual.) ☐ Fit Test Current (Quant.)
Name: **Title:** **Task(s):** **Certification Level or Description:** ☐ Medical Current ☐ Training Current ☐ Fit Test Current (Qual.) ☐ Fit Test Current (Quant.)	**Name:** **Title:** **Task(s):** **Certification Level or Description:** ☐ Medical Current ☐ Training Current ☐ Fit Test Current (Qual.) ☐ Fit Test Current (Quant.)
Name: **Title:** **Task(s):** **Certification Level or Description:** ☐ Medical Current ☐ Training Current ☐ Fit Test Current (Qual.) ☐ Fit Test Current (Quant.)	**Name:** **Title:** **Task(s):** **Certification Level or Description:** ☐ Medical Current ☐ Training Current ☐ Fit Test Current (Qual.) ☐ Fit Test Current (Quant.)

TRAINING CURRENT - Training: All personnel, including visitors, entering the exclusion or contamination reduction zones must have certifications of completion of training in accordance with OSHA 29 CFR 1910, 29 CFR 1926 or 29 CFR 1910.120.

FIT TEST CURRENT - Respirator Fit Testing: All persons, including visitors, entering any area requiring the use or potential use of any negative pressure respirator must have had as a minimum, a qualitative fit test, administered in accordance with OSHA 29 CFR 1910.134 or ANSI within the last 12 months. If site conditions *require the use of a full face negative pressure, air purifying respirator for protection from Asbestos or Lead, employees must have had a quantitative fit test,* administered according to OSHA 29 CFR 1910.1001 or 1025 within the last 6 months.

MEDICAL CURRENT - Medical Monitoring Requirements: All personnel, including visitors, entering the exclusion or contamination reduction zones must be certified *as medically fit to work, and to wear a respirator, if appropriate, in accordance with 29 CFR 1910, 29 CFR 1926/1910 or 29 CFR 1910.120.*

The Site Health and Safety Coordinator is responsible for verifying all certifications and fit tests.

Subcontractor's Health and Safety Program Evaluation

Name of Subcontractor:
Address:

Activities to Be Conducted by Subcontractor:

Evaluation Criteria

Medical program meets OSHA/WESTON criteria ☐ Acceptable ☐ Unacceptable Comments:	Personal protective equipment available ☐ Acceptable ☐ Unacceptable Comments:	On-site monitoring equipment available, calibrated and operated properly ☐ Acceptable ☐ Unacceptable Comments:
Safe working procedures clearly specified ☐ Acceptable ☐ Unacceptable Comments:	Training meets OSHA/WESTON criteria ☐ Acceptable ☐ Unacceptable Comments:	Emergency procedures ☐ Acceptable ☐ Unacceptable Comments:
Decontamination procedures ☐ Acceptable ☐ Unacceptable Comments:	General health and safety program evaluation ☐ Acceptable ☐ Unacceptable Comments:	Additional comments: ☐ Subcontractor has agreed to and will conform with the WESTON HASP for this Project. ☐ Subcontractor will work under his own HASP which has been accepted by Corporate Health and Safety.

Evaluation Conducted by: **Date:**

Subcontractor

Name: **Title:** **Task(s):** **Certification Level or Description:** ☐ Medical Current ☐ Training Current ☐ Fit Test Current (Qual.) ☐ Fit Test Current (Quant.)	**Name:** **Title:** **Task(s):** **Certification Level or Description:** ☐ Medical Current ☐ Training Current ☐ Fit Test Current (Qual.) ☐ Fit Test Current (Quant.)
Name: **Title:** **Task(s):** **Certification Level or Description:** ☐ Medical Current ☐ Training Current ☐ Fit Test Current (Qual.) ☐ Fit Test Current (Quant.)	**Name:** **Title:** **Task(s):** **Certification Level or Description:** ☐ Medical Current ☐ Training Current ☐ Fit Test Current (Qual.) ☐ Fit Test Current (Quant.)
Name: **Title:** **Task(s):** **Certification Level or Description:** ☐ Medical Current ☐ Training Current ☐ Fit Test Current (Qual.) ☐ Fit Test Current (Quant.)	**Name:** **Title:** **Task(s):** **Certification Level or Description:** ☐ Medical Current ☐ Training Current ☐ Fit Test Current (Qual.) ☐ Fit Test Current (Quant.)

HEALTH AND SAFETY PLAN APPROVAL/SIGNOFF FORM

Site Name: Delta Shipyard

WO# 04603-026-031-0300-00

Address: 202 Industrial Boulevard, Houma, Louisiana

I understand, agree to and will conform with the information set forth in this Health and Safety Plan (and attachments) and discussed in the Personnel Health and Safety briefing(s).

Name	Signature	Date
Joy Ishigo		3/7/96
Eric Tate		3/7/96
Reed K. Wilson		6/27/96

TRAINING AND BRIEFING TOPICS

The following items will be covered at the site specific training meeting, daily or periodically.

☒ Site characterization and analysis, Sec. 3.0, 29 CFR 1910.120 i	☐ Level A
☒ Physical hazards, Table 3.2	☐ Level B
☒ Chemical hazards, Table 3.1	☒ Level C
☒ Animal bites, stings, and poisonous plants	☒ Level D
☐ Etiologic (infectious) agents	☒ Monitoring, Sec. 7.0; 29 CFR 1910.120 h
☒ Site control, Sec. 8.0; 29 CFR 1910.120 d	☒ Decontamination, Sec. 9.0; 29 CFR 1910.120 k
☒ Engineering controls and work practices, Sec. 8.5; 25 CFR 1910.120 g	☐ Emergency response, Sec. 10.0; 29 CFR 1910.120 l
☐ Heavy machinery	☐ Elements of an emergency response, Sec. 100; 29 CFR 1910.120 l
☐ Forklift	☒ Procedures for handling site emergency incidents, Sec. 10.0; 29 CFR 1910.120 l
☐ Backhoe	☐ Off-site emergency response, 29 CFR 1910.120 l
☒ Equipment	☐ Handling drums and containers, 29 CFR 1910.120 j
☒ Tools	☐ *Opening drums and containers*
☐ Ladder 29 CFR 1910.27 d	☐ Electrical material handling equipment
☐ Overhead and underground utilities	☐ Radioactive waste
☐ Scaffolds	☐ Shock sensitive waste
☐ Structural integrity	☐ Laboratory waste packs
☐ Unguarded openings - wall, floor, ceilings	☐ Sampling drums and containers
☐ Pressurized air cylinders	☒ Shipping and transport, 49 CFR 172.101
☒ *Personnel protective equipment*, Sec. 5.0; 25 CFR 1910.120 g; 29 CFR 1910.134	☐ Tank and vault procedures
☒ Respiratory protection, Sec. 5.8; 29 CFR 1910.120 g; Z88.2-1980	☐ Illumination, 29 CFR 1910.120 m
	☐ Sanitation, 29 CFR 1910.120 n

ATTACHMENT "A"

CHEMICAL CONTAMINANTS

DATA SHEETS

(Use HASP Form 33HASP.894
or attach appropriate data sheets.)

HEALTH AND SAFETY EVALUATION – ☐ CHEMICAL HAZARDS

Hazardous Substance/Tasks	Physical Properties	Normal Physical State	State At Site/Proj. Temp.	Characteristics	Exposure Limits	Route(s) of Exposure/ Symptoms	Monitoring Instruments/ Ionization Potential + % Response
Chrysene	☐ Explosive ☐ Flammable ☐ Corrosive ☐ Reactive ☐ Water Reactive ☐ Oxidizer ☐ Radioactive ☒ Other When heated to decomp. emits acrid smoke & fumes	☐ Solid ☐ Liquid ☐ Gas	☐ Solid ☐ Liquid ☐ Gas	pH: FP: LEL: UEL: Auto. Ig.: BP: 838.4°F MP: 489.2°F Sp. Gr.: Vap. D.: Vap. P.: H_2O Sol.: Insol. Other: Sl sol. in alc, ether, carbon disulfide, glacial acetic acid. Sl sol. in cold organic solvents. Occurs in coal tar	☐ CA ☒ PEL 0.2 mg/m³ ☐ TLV ☐ IDLH ☒ Only toxicological data available ☐ Other:	☐ Inhalation ☐ Ingestion ☐ Skin Absorption ☒ Contact ☐ Direct Penetration ☐ Other:	☐ PID ☐ 11.7 eV ☐ 10.2 eV ☐ OVM ☐ CGI ☒ OVA ☐ _____
CAS No: 218-01-9	Incompatible With:					Symptoms: An experimental carcinogen, neoplastigen & tumorigen	IP: % Response:
Synonyms: 1,2 Benzophenanthrene, Benzo(a)phenanthrene, 1,2 Benzphenanthrene.							

1 1E

HEALTH AND SAFETY EVALUATION – ☐ CHEMICAL HAZARDS

Hazardous Substance/Tasks	Physical Properties	Normal Physical State	State At Site/Proj. Temp.	Characteristics	Exposure Limits	Route(s) of Exposure/ Symptoms	Monitoring Instruments/ Ionization Potential + % Response
Pyrene	☐ Explosive ☐ Flammable ☐ Corrosive ☐ Reactive ☐ Water Reactive ☐ Oxidizer	☒ Solid ☐ Liquid ☐ Gas	☒ Solid ☐ Liquid ☐ Gas	pH: FP: LEL: UEL: Auto. Ig.: BP: 759.2 °F	☐ CA ☒ PEL 0.2mg/m³ ☐ TLV ☐ IDLH ☐ Only toxicological data available ☐ Other:	☒ Inhalation ☒ Ingestion ☐ Skin Absorption ☒ Contact ☐ Direct Penetration ☐ Other:	☐ PID ☐ 11.7 eV ☐ 10.2 eV ☐ OVM ☐ CGI ☒ OVA ☐
CAS No: 129-00-0	☐ Radioactive ☒ Other When heated to decomp. it emits acrid smoke: irritating fumes.	Incompatible With:		MP: 312.8°F Sp. Gr.: Vap. D.: Vap. P.: H_2O Sol.: ins. Other:			
Synonyms: β-Pyrene, Benzo(def) phenanthrene, Pyren						Symptoms:	IP: % Response:

HEALTH AND SAFETY EVALUATION – ☐ CHEMICAL HAZARDS

Hazardous Substance/Tasks	Physical Properties	Normal Physical State	State At Site/Proj. Temp.	Characteristics	Exposure Limits	Route(s) of Exposure/ Symptoms	Monitoring Instruments/ Ionization Potential + % Response
Fluoranthene	☐ Explosive ☐ Flammable ☐ Corrosive ☐ Reactive ☐ Water Reactive ☐ Oxidizer	☒ Solid ☐ Liquid ☐ Gas	☒ Solid ☐ Liquid ☐ Gas	pH: FP: LEL: UEL: Auto. Ig.: BP:	☐ CA ☒ PEL 0.2mg/m³ ☐ TLV _____ ☐ IDLH _____ ☐ Only toxicological data available ☐ Other:	☐ Inhalation ☒ Ingestion ☐ Skin Absorption ☒ Contact ☒ Direct Penetration ☐ Other:	☐ PID ☐ 11.7 eV ☐ 10.2 eV ☐ OVM ☐ CGI ☒ OVA ☐ _____
CAS No: 206-44-0	☐ Radioactive ☒ Other Combustable. Emits acrid smoke & irritating fumes when heated to decomp.	Incompatible With:		MP: Sp. Gr.: Vap. D.: Vap. P.: H_2O Sol.: Other:		Symptoms:	IP: % Response:
Synonyms: 1,2 Benzacenaphthene), Benzo(jk) fluorene, Idryl)							

HEALTH AND SAFETY EVALUATION – ☐ CHEMICAL HAZARDS

Hazardous Substance/Tasks	Physical Properties	Normal Physical State	State At Site/Proj. Temp.	Characteristics	Exposure Limits	Route(s) of Exposure/ Symptoms	Monitoring Instruments/ Ionization Potential + % Response
2-Methyl-naphthalene	☐ Explosive ☒ Flammable ☐ Corrosive ☐ Reactive ☐ Water Reactive ☐ Oxidizer ☐ Radioactive ☐ Other	☒ Solid ☐ Liquid ☐ Gas	☒ Solid ☐ Liquid ☐ Gas	pH: FP: LEL: UEL: Auto. Ig.: BP: 241.1 °C	☐ CA ☐ PEL _____ ☐ TLV _____ ☐ IDLH _____ ☒ Only toxicological data available ☒ Other: orl-rat LD50: 1630 mg/kg ipr-mus LDLo: 1000 mg/kg	☐ Inhalation ☒ Ingestion ☒ Skin Absorption ☐ Contact ☐ Direct Penetration ☐ Other:	☐ PID ☐ 11.7 eV ☐ 10.2 eV ☐ OVM ☐ CGI ☑ OVA ☐ _____
CAS No: 91-57-6		Incompatible With:		MP: 34.58 °C			
Synonyms: β-Methyl-naphthalene				Sp. Gr.: Vap. D.: Vap. P.: H_2O Sol.: Other: Density: 1.0058 @ 20°/4°. Insoluble in water. Soluable in alcohol & ether.		Symptoms:	IP: % Response:

HEALTH AND SAFETY EVALUATION – ☐ CHEMICAL HAZARDS

Hazardous Substance/Tasks	Physical Properties	Normal Physical State	State At Site/Proj. Temp.	Characteristics	Exposure Limits	Route(s) of Exposure/ Symptoms	Monitoring Instruments/ Ionization Potential + % Response
Dibenz(a,h) anthracene	☐ Explosive ☐ Flammable ☐ Corrosive ☐ Reactive ☐ Water Reactive ☐ Oxidizer ☐ Radioactive ☒ Other When heated to decomposition emits acrid smoke: irritating fumes	☐ Solid ☐ Liquid ☐ Gas	☐ Solid ☐ Liquid ☐ Gas	pH: FP: LEL: UEL: Auto. Ig.: BP:	☐ CA ☐ PEL _____ ☐ TLV _____ ☐ IDLH _____ ☐ Only toxicological data available	☐ Inhalation ☐ Ingestion ☐ Skin Absorption ☐ Contact ☒ Direct Penetration ☐ Other:	☐ PID ☐ 11.7 eV ☐ 10.2 eV ☐ OVM ☐ CGI ☒ OVA ☐ _____
CAS No: 53-70-3		Incompatible With:		MP: Sp. Gr.: Vap. D.: Vap. P.: H_2O Sol.: Other:	☒ Other: NTP 5th Annual Rpt. on Carcinogens. IARC Cancer Review: Group 2A Imemdt 7, 56, 87; Animal Sufficient evidence IMEMDT 32, 299, 83; IMEMDT 3, 178, 73. EPA Genetic Toxicology Program. Rpt a. in EPA TSCA Inventory	Symptoms:	IP: % Response:
Synonyms: 1,2:5,6 Benz anthracene, DBA, DB(a,h)A, 1,2,5,6-DBA, 1,2,5,6 Dibenzanthracene 1,2:5,6-Dibenzathracene, RCRA Waste # U063							

HEALTH AND SAFETY EVALUATION – ☐ CHEMICAL HAZARDS

Hazardous Substance/Tasks	Physical Properties	Normal Physical State	State At Site/Proj. Temp.	Characteristics	Exposure Limits	Route(s) of Exposure/ Symptoms	Monitoring Instruments/ Ionization Potential + % Response
Carbazole	☐ Explosive ☐ Flammable ☐ Corrosive ☐ Reactive ☐ Water Reactive ☐ Oxidizer	☒ Solid ☐ Liquid ☐ Gas	☒ Solid ☐ Liquid ☐ Gas	pH: FP: LEL: UEL: Auto. Ig.: BP: 354.8°C	☐ CA ☐ PEL _____ ☐ TLV _____ ☐ IDLH _____ ☐ Only toxicological data available	☐ Inhalation ☒ Ingestion ☐ Skin Absorption ☐ Contact ☐ Direct Penetration ☐ Other:	☐ PID ☐ 11.7 eV ☐ 10.2 eV ☐ OVM ☐ CGI ☒ OVA ☐ _____
CAS No: 86-74-8	☐ Radioactive ☒ Other emits toxic fumes of NO_x when heated to decomposition	Incompatible With:		MP: 244.8°C Sp. Gr.:	☒ Other: Carcinogen Reports: IARC Cancer Review: Group 3 IMEHDT 7, 56, 87; Animal Limited Evidence IMEHDT 32, 259, 83. Reported in EPA TSCA Inventory		
Synonyms: 9-azafluorene, 9H-Carbazole, Dibenzopyrrole, Dibenzo(b,d) pyrrole, Diphenyleneimine, Diphenylenimide, Diphenylketimine, USAF EK-600				Vap. D.: Vap. P.: 400m@ 323°C H_2O Sol.: Other: Density = 1.10 @ 18°/4°		Symptoms:	IP: % Response:

HEALTH AND SAFETY EVALUATION – ☐ CHEMICAL HAZARDS

Hazardous Substance/Tasks	Physical Properties	Normal Physical State	State At Site/Proj. Temp.	Characteristics	Exposure Limits	Route(s) of Exposure/ Symptoms	Monitoring Instruments/ Ionization Potential + % Response
Vanadium	☐ Explosive ☒ Flammable ☐ Corrosive ☒ Reactive ☐ Water Reactive ☐ Oxidizer ☐ Radioactive ☒ Other When heated to decomp. emits toxic fumes of VO_x slightly radioactive	☒ Solid ☐ Liquid ☐ Gas	☒ Solid ☐ Liquid ☐ Gas	pH: FP: LEL: UEL: Auto. Ig.: BP: 5432 °F	☐ CA ☒ PEL .005mg/m3 ☐ TLV _____ ☐ IDLH _____ ☐ Only toxicological data available ☐ Other:	☐ Inhalation ☐ Ingestion ☐ Skin Absorption ☐ Contact ☐ Direct Penetration ☒ Other: Poison by subcutaneous route	☐ PID ☐ 11.7 eV ☐ 10.2 eV ☐ OVM ☐ CGI ☒ OVA ☐ _____
CAS No: 7440-62-2		Incompatible With: Violent reaction w/ BrF_3, Cl_2, lithium, vinyl fluoride, oxidants	MP: 3482.6 °F Sp. Gr.: Vap. D.: Vap. P.: H_2O Sol.: Insol. Other:			Symptoms:	IP: % Response:
Synonyms:							

HEALTH AND SAFETY EVALUATION – ☐ CHEMICAL HAZARDS

Hazardous Substance/Tasks	Physical Properties	Normal Physical State	State At Site/Proj. Temp.	Characteristics	Exposure Limits	Route(s) of Exposure/ Symptoms	Monitoring Instruments/ Ionization Potential + % Response
Phenanthrene	☐ Explosive ☒ Flammable ☐ Corrosive ☒ Reactive ☐ Water Reactive ☐ Oxidizer ☐ Radioactive ☒ Other When heated to decomp. emits Acrid smoke	☒ Solid ☐ Liquid ☐ Gas	☒ Solid ☐ Liquid ☐ Gas	pH: FP: LEL: UEL: Auto. Ig.: BP:	☐ CA ☒ PEL 0.2mg/m³ ☐ TLV _____ ☐ IDLH _____ ☐ Only toxicological data available ☐ Other:	☐ Inhalation ☒ Ingestion ☐ Skin Absorption ☐ Contact ☒ Direct Penetration ☐ Other:	☐ PID ☐ 11.7 eV ☐ 10.2 eV ☐ OVM ☐ CGI ☒ OVA ☐ _____
CAS No: 85-01-8		Incompatible With:		MP: Sp. Gr.: Vap. D.: Vap. P.: 1mm@245°F H_2O Sol.: Ins. Other:		Symptoms:	IP: % Response:
Synonyms: Phenanthrin							

HEALTH AND SAFETY EVALUATION – ☐ CHEMICAL HAZARDS

Hazardous Substance/Tasks	Physical Properties	Normal Physical State	State At Site/Proj. Temp.	Characteristics	Exposure Limits	Route(s) of Exposure/ Symptoms	Monitoring Instruments/ Ionization Potential + % Response
Heptachlor epoxide	☐ Explosive ☐ Flammable ☐ Corrosive ☐ Reactive ☐ Water Reactive ☐ Oxidizer	☒ Solid ☐ Liquid ☐ Gas	☒ Solid ☐ Liquid ☐ Gas	pH: FP: LEL: NA UEL: NA Auto. Ig.: BP: 293° (Decomp)	☐ CA ☒ PEL 0.5mg/m³ ☐ TLV ☐ IDLH ☐ Only toxicological data available ☐ Other:	☒ Inhalation ☒ Ingestion ☒ Skin Absorption ☐ Contact ☐ Direct Penetration ☐ Other:	☐ PID ☐ 11.7 eV ☐ 10.2 eV ☐ OVM ☐ CGI ☒ OVA ☐
CAS No: 1024-57-3	☐ Radioactive ☒ Other When heated to decomposition it emits toxic fumes of Cl⁻	Incompatible With: Iron, rust		MP: Sp. Gr.: 1.66 Vap. D.: Vap. P.: 77° 0.0003mm H_2O Sol.: 0.00067o Other:			
Synonyms: Epoxyheptachlor, velsicol, HCE,						Symptoms: tremor, convulsions, liver damage	IP: % Response:

HEALTH AND SAFETY EVALUATION – ☐ CHEMICAL HAZARDS

Hazardous Substance/Tasks	Physical Properties	Normal Physical State	State At Site/Proj. Temp.	Characteristics	Exposure Limits	Route(s) of Exposure/ Symptoms	Monitoring Instruments/ Ionization Potential + % Response
Barium	☐ Explosive ☒ Flammable ☐ Corrosive ☒ Reactive ☒ Water Reactive ☐ Oxidizer ☐ Radioactive ☐ Other	☒ Solid ☐ Liquid ☐ Gas	☒ Solid ☐ Liquid ☐ Gas	pH: FP: LEL: UEL: Auto. Ig.: BP: 1640° MP: 725° Sp. Gr.: Vap. D.: Vap. P.: 10 mm @ 1049° H_2O Sol.: Other: density = 3.5 @ 20°	☐ CA ☒ PEL 0.5mg/m³ ☐ TLV ☐ IDLH ☐ Only toxicological data available ☐ Other:	☐ Inhalation ☒ Ingestion ☐ Skin Absorption ☐ Contact ☐ Direct Penetration ☐ Other:	☐ PID ☐ 11.7 eV ☐ 10.2 eV ☐ OVM ☐ CGI ☒ OVA ☐ _____
CAS No: 7440-39-3		Incompatible With: Water, CCl_4, fluorotrichloro methane, trichloro ethylene, and CCl_4, acids, $C_2Cl_3F_3$, $C_2H_2FCl_3$, C_2HCl_3, 1,1,2 trichloro trifluoro ethane, fluorotrichloro ethene.					
Synonyms:						Symptoms: Poisoning, vomiting, colic, diarrhea, slow irregular pulse, transient hypertension, convulsive tremors and muscular paralysis.	IP: % Response:

HEALTH AND SAFETY EVALUATION – ☐ CHEMICAL HAZARDS

Hazardous Substance/Tasks	Physical Properties	Normal Physical State	State At Site/Proj. Temp.	Characteristics	Exposure Limits	Route(s) of Exposure/ Symptoms	Monitoring Instruments/ Ionization Potential + % Response
Aluminum	☒ Explosive ☐ Flammable ☒ Corrosive ☒ Reactive ☐ Water Reactive ☒ Oxidizer ☐ Radioactive ☐ Other	☒ Solid ☐ Liquid ☐ Gas	☒ Solid ☐ Liquid ☐ Gas	pH: FP: NA LEL: NA UEL: NA Auto. Ig.: BP: 4221°F MP: 1220°F Sp. Gr.: 2.70 Vap. D.: Vap. P.: Onm H_2O Sol.: Insoluble Other: Combustable solid. Finely divided dust is easily ignited, may cause explosions	☐ CA ☒ PEL 5mg/m³ ☐ TLV ☒ IDLH N.D. ☐ Only toxicological data available ☐ Other:	☒ Inhalation ☐ Ingestion ☐ Skin Absorption ☒ Contact ☐ Direct Penetration ☐ Other:	☐ PID ☐ 11.7 eV ☐ 10.2 eV ☐ OVM ☐ CGI ☒ OVA ☐
CAS No: 7429-90-5		Incompatible With: Halogens, acids, strong oxidizers		MP: 1220°F		Symptoms: Irritated eyes, skin, resp. system	IP:
Synonyms: Aluminum metal, Aluminum powder, Elemental Aluminum							% Response:

HEALTH AND SAFETY EVALUATION – ☐ CHEMICAL HAZARDS

Hazardous Substance/Tasks	Physical Properties	Normal Physical State	State At Site/Proj. Temp.	Characteristics	Exposure Limits	Route(s) of Exposure/ Symptoms	Monitoring Instruments/ Ionization Potential + % Response
Antimony	☐ Explosive ☒ Flammable ☐ Corrosive ☐ Reactive ☐ Water Reactive ☐ Oxidizer ☐ Radioactive ☐ Other	☒ Solid ☐ Liquid ☐ Gas	☒ Solid ☐ Liquid ☐ Gas	pH: FP: LEL: NA UEL: NA Auto. Ig.: BP: 2975°F MP: 1166°F Sp. Gr.: 6.69 Vap. D.: Vap. P.: 0mm H_2O Sol.: Insoluable Other: Non combustible solid in bulk form, but a moderate explosion hazard in the form of dust when exposed to flame	☐ CA ☒ PEL 0.5mg/m³ ☐ TLV ☒ IDLH 50mg/m³ ☐ Only toxicological data available ☐ Other:	☒ Inhalation ☒ Ingestion ☐ Skin Absorption ☒ Contact ☐ Direct Penetration ☐ Other:	☐ PID ☐ 11.7 eV ☐ 10.2 eV ☐ OVM ☐ CGI ☒ OVA ☐
CAS No: 7440-36-0		Incompatible With: Strong oxidizers, acids, halogenated acids					
Synonyms: Antimony metal, Antimony powder, Stibium						Symptoms: Irrit. eyes, skin, nose, throat; cough; dizz; headj; nausea, vomit, diarh, stomach cramps; insomnia; anor; unable to smell properly	IP: % Response:

HEALTH AND SAFETY EVALUATION – ☐ CHEMICAL HAZARDS

Hazardous Substance/Tasks	Physical Properties	Normal Physical State	State At Site/Proj. Temp.	Characteristics	Exposure Limits	Route(s) of Exposure/ Symptoms	Monitoring Instruments/ Ionization Potential + % Response
Cadmium	☐ Explosive ☒ Flammable ☐ Corrosive ☐ Reactive ☐ Water Reactive ☐ Oxidizer ☐ Radioactive ☐ Other	☒ Solid ☐ Liquid ☐ Gas	☒ Solid ☐ Liquid ☐ Gas	pH: FP: LEL: NA UEL: NA Auto. Ig.: BP: 1409 °F MP: 610°F Sp. Gr.: Vap. D.: Vap. P.: 0mm H_2O Sol.: Ins. Other:	☒ CA ☒ PEL 0.005 ☐ TLV _____ ☐ IDLH _____ ☐ Only toxicological data available ☐ Other:	☒ Inhalation ☒ Ingestion ☐ Skin Absorption ☐ Contact ☐ Direct Penetration ☐ Other:	☐ PID ☐ 11.7 eV ☐ 10.2 eV ☐ OVM ☐ CGI ☒ OVA ☐ _____
CAS No: 7440-43-9		Incompatible With: strong oxidizers; elemental sulfur, selenium; tellurium				Symptoms: Pulm edema, dyspnea, cough, chest tight, subs pain, head, chills, muscaches, nausea, vomit, diarrhea, cramping, prot, mild anemia	IP: % Response:
Synonyms: Cadmium metal							

HEALTH AND SAFETY EVALUATION – ☐ CHEMICAL HAZARDS

Hazardous Substance/Tasks	Physical Properties	Normal Physical State	State At Site/Proj. Temp.	Characteristics	Exposure Limits	Route(s) of Exposure/ Symptoms	Monitoring Instruments/ Ionization Potential + % Response
Selenium	☐ Explosive ☐ Flammable ☐ Corrosive ☒ Reactive ☐ Water Reactive ☐ Oxidizer	☒ Solid ☐ Liquid ☐ Gas	☒ Solid ☐ Liquid ☐ Gas	pH: FP: LEL: NA UEL: NA Auto. Ig.: BP: 1265°F	☐ CA ☒ PEL 0.2mg/m³ ☐ TLV _____ ☐ IDLH _____ ☐ Only toxicological data available	☒ Inhalation ☒ Ingestion ☐ Skin Absorption ☒ Contact ☐ Direct Penetration ☐ Other:	☐ PID ☐ 11.7 eV ☐ 10.2 eV ☐ OVM ☐ CGI ☒ OVA ☐ _____
CAS No: 7782-49-2	☐ Radioactive ☒ Other When heated to decomposition emits toxic fumes. Can react violently w/ zinc, silver bromate, strontium carbide, thorium carbide, uranium, metals, calcium carbide, chlorates.	Incompatible With: Acids, strong oxidizers, chromium trioxide, potassium bromate, cadmium.	MP: 392°F Sp. Gr.: Vap. D.: Vap. P.: Immeasurable H_2O Sol.: Insoluable Other:	☐ Other:	Symptoms: Irrit eyes, skin nose, throat. Vis. dist; head; chills, fever; dysp, bron; metallic taste, garlic breath, GI dist; derm: eye, skin burns.	IP: % Response:
Synonyms: Selenium alloy, colloidal selenium, Selen, Vandex							

HEALTH AND SAFETY EVALUATION — ☐ CHEMICAL HAZARDS

Hazardous Substance/Tasks	Physical Properties	Normal Physical State	State At Site/Proj. Temp.	Characteristics	Exposure Limits	Route(s) of Exposure/ Symptoms	Monitoring Instruments/ Ionization Potential + % Response
Lead	☒ Explosive ☒ Flammable ☐ Corrosive ☒ Reactive ☐ Water Reactive ☐ Oxidizer ☐ Radioactive ☐ Other	☒ Solid ☐ Liquid ☐ Gas	☒ Solid ☐ Liquid ☐ Gas	pH: FP: LEL: NA UEL: NA Auto. Ig.: BP: 3164°F MP: 621°F Sp. Gr.: Vap. D.: Vap. P.: 1mm @973°C H_2O Sol.: Ins Other:	☐ CA ☐ PEL 0.05 mg/m³ ☐ TLV ☐ IDLH ☐ Only toxicological data available ☐ Other:	☒ Inhalation ☒ Ingestion ☐ Skin Absorption ☒ Contact ☐ Direct Penetration ☐ Other:	☐ PID ☐ 11.7 eV ☐ 10.2 eV ☐ OVM ☐ CGI ☒ OVA ☐ ______
CAS No: 7439-92-1		Incompatible With: Strong oxidizers, hydrogen peroxide, acids					IP:
Synonyms: Plumbum, Olow, Omaha EI, SO, Glover						Symptoms: Weak, lass, insom; facial pallor; pal eye, anor, low weight, malnut, constip, abdom pain, colic, anemia, gingival lead line, tremor, para wrist, ankles, encephalopathy; kidney disease, irrit eyes, hypotension	% Response:

REDACTED

HEALTH AND SAFETY EVALUATION – ☐ CHEMICAL HAZARDS

Hazardous Substance/Tasks	Physical Properties	Normal Physical State	State At Site/Proj. Temp.	Characteristics	Exposure Limits	Route(s) of Exposure/ Symptoms	Monitoring Instruments/ Ionization Potential + % Response
Chromium	☒ Explosive ☐ Flammable ☐ Corrosive ☒ Reactive ☐ Water Reactive ☐ Oxidizer ☐ Radioactive ☒ Other Will explode	☒ Solid ☐ Liquid ☐ Gas	☒ Solid ☐ Liquid ☐ Gas	pH: FP: LEL: UEL: Auto. Ig.: BP: MP: Sp. Gr.: Vap. D.: Vap. P.: H_2O Sol.: Other:	☐ CA ☐ PEL 1mg/m³ ☐ TLV _____ ☐ IDLH _____ ☐ Only toxicological data available ☒ Other: ACGIH TLV: 0.5mg/m³	☒ Inhalation ☐ Ingestion ☐ Skin Absorption ☐ Contact ☐ Direct Penetration ☐ Other:	☐ PID ☐ 11.7 eV ☐ 10.2 eV ☐ OVM ☐ CGI ☒ OVA ☐: _____
CAS No: 7440-47-3		Incompatible With: Oxidants,				Symptoms: Irrit eyes, sens derm.	IP:
Synonyms: Chrome							% Response:

HEALTH AND SAFETY EVALUATION – ☐ CHEMICAL HAZARDS

Hazardous Substance/Tasks	Physical Properties	Normal Physical State	State At Site/Proj. Temp.	Characteristics	Exposure Limits	Route(s) of Exposure/ Symptoms	Monitoring Instruments/ Ionization Potential + % Response
Coal Tar Pitch Volatiles	☐ Explosive ☐ Flammable ☐ Corrosive ☐ Reactive ☐ Water Reactive ☐ Oxidizer	☐ Solid ☒ Liquid ☐ Gas	☒ Solid ☐ Liquid ☐ Gas	pH: FP: LEL: UEL: Auto. Ig.: BP:	☐ CA ☐ PEL _____ ☐ TLV _____ ☐ IDLH _____ ☐ Only toxicological data available	☒ Inhalation ☐ Ingestion ☐ Skin Absorption ☒ Contact ☐ Direct Penetration ☐ Other:	☐ PID ☐ 11.7 eV ☐ 10.2 eV ☐ OVM ☐ CGI ☒ OVA ☐: _____
CAS No: 65996-93-2	☒ Other Combustable	Incompatible With:		MP: Sp. Gr.:	☒ Other: OSHA 0.2mg/m³		
Synonyms:				Vap. D.: Vap. P.: H_2O Sol.: Other: Properties vary depending upon the specific compound		Symptoms: Derm, bron, [carc]	IP: % Response:

ATTACHMENT "B"

MATERIAL SAFETY DATA SHEETS (MSDS)

ANTHRACENE

ATH

Common Synonyms	Solid	White to yellow	Weak aromatic odor
Anthracin Paranaphthalene Green oil	Sinks in water.		

Stop discharge if possible. Keep people away.
Avoid contact with solid and dust.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

Combustible.
Dust cloud may explode if ignited in an enclosed area.
Extinguish with water, dry chemicals, foam, or carbon dioxide.

Exposure

CALL FOR MEDICAL AID.

DUST
Irritating to eyes, nose and throat.
If inhaled will cause coughing or difficult breathing.
If in eyes, hold eyelids open and flush with plenty of water.
If breathing has stopped, give artificial respiration.
If breathing is difficult, give oxygen.

SOLID
Irritating to skin and eyes.
Harmful if swallowed.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.
IF SWALLOWED and victim is UNCONSCIOUS OR HAVING CONVULSIONS, do nothing except keep victim warm.

Water Pollution

Effect of low concentrations on aquatic life is unknown.
May be dangerous if it enters water intakes.
Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

Should be removed.
Chemical and physical treatment.

2. LABEL

2.1 Category: None
2.2 Class: Not pertinent

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Not listed
3.2 Formula: $C_{14}H_{10}$
3.3 IMO/UN Designation: Not listed
3.4 DOT ID No.: Data not available
3.5 CAS Registry No.: 120-12-7

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Solid
4.2 Color: White to yellow
4.3 Odor: Weak aromatic

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Dust mask; goggles or face shield; rubber gloves
5.2 Symptoms Following Exposure: Inhalation of dust irritates nose and throat. Contact with eyes causes irritation.
5.3 Treatment of Exposure: INHALATION: move to fresh air. EYES: flush with water for 15 min.
5.4 Threshold Limit Value: Data not available
5.5 Short Term Inhalation Limits: Data not available
5.6 Toxicity by Ingestion: Data not available
5.7 Late Toxicity: Data not available
5.8 Vapor (Gas) Irritant Characteristics: Data not available
5.9 Liquid or Solid Irritant Characteristics: Data not available
5.10 Odor Threshold: Data not available
5.11 IDLH Value: Data not available

6. FIRE HAZARDS

6.1 Flash Point: 250°F
6.2 Flammable Limits in Air: 0.6% LEL
6.3 Fire Extinguishing Agents: Water, foam, dry chemical, carbon dioxide
6.4 Fire Extinguishing Agents Not to be Used: Data not available
6.5 Special Hazards of Combustion Products: Data not available
6.6 Behavior in Fire: Data not available
6.7 Ignition Temperature: 1004°F
6.8 Electrical Hazard: Not pertinent
6.9 Burning Rate: Not pertinent
6.10 Adiabatic Flame Temperature: Data not available
6.11 Stoichiometric Air to Fuel Ratio: Data not available
6.12 Flame Temperature: Data not available

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: No reaction
7.2 Reactivity with Common Materials: Data not available
7.3 Stability During Transport: Stable
7.4 Neutralizing Agents for Acids and Caustics: Not pertinent
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Molar Ratio (Reactant to Product): Data not available
7.8 Reactivity Group: Data not available

8. WATER POLLUTION

8.1 Aquatic Toxicity: 5 ppm/24 hr/trout & bluegill/no effect
8.2 Waterfowl Toxicity: Data not available
8.3 Biological Oxygen Demand (BOD): Data not available
8.4 Food Chain Concentration Potential: None

9. SHIPPING INFORMATION

9.1 Grades of Purity: Various fluorescence grades; Scintillation grade; Technical grade, 90-96%
9.2 Storage Temperature: Ambient
9.3 Inert Atmosphere: No requirement
9.4 Venting: Open

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

II

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: Not listed
11.2 NAS Hazard Rating for Bulk Water Transportation: Not listed
11.3 NFPA Hazard Classification:

Category	Classification
Health Hazard (Blue)	0
Flammability (Red)	1
Reactivity (Yellow)	0

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Solid
12.2 Molecular Weight: 178.23
12.3 Boiling Point at 1 atm: 646.2°F = 341.2°C = 614.4°K
12.4 Freezing Point: 421.7°F = 216.5°C = 489.7°K
12.5 Critical Temperature: Not pertinent
12.6 Critical Pressure: Not pertinent
12.7 Specific Gravity: 1.24 at 20°C (solid)
12.8 Liquid Surface Tension: Not pertinent
12.9 Liquid Water Interfacial Tension: Not pertinent
12.10 Vapor (Gas) Specific Gravity: Not pertinent
12.11 Ratio of Specific Heats of Vapor (Gas): Not pertinent
12.12 Latent Heat of Vaporization: Not pertinent
12.13 Heat of Combustion: -17,100 Btu/lb = -9,510 cal/g = -398 X 10^3 J/kg
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: Not pertinent
12.16 Heat of Polymerization: Not pertinent
12.25 Heat of Fusion: 38.70 cal/g
12.26 Limiting Value: Data not available
12.27 Reid Vapor Pressure: Data not available

NOTES

ANTHRACENE

12.17 SATURATED LIQUID DENSITY	
Temperature (degrees F)	Pounds per cubic foot
	NOT PERTINENT

12.18 LIQUID HEAT CAPACITY	
Temperature (degrees F)	British thermal unit per pound-F
	NOT PERTINENT

12.19 LIQUID THERMAL CONDUCTIVITY	
Temperature (degrees F)	British thermal unit-inch per hour-square foot-F
435	.868
440	.866
445	.865
450	.863
455	.862
460	.860
465	.859
470	.857
475	.855
480	.854
485	.852
490	.851
495	.849
500	.848
505	.846
510	.845
515	.843
520	.842
525	.840
530	.839

12.20 LIQUID VISCOSITY	
Temperature (degrees F)	Centipoise
	NOT PERTINENT

12.21 SOLUBILITY IN WATER	
Temperature (degrees F)	Pounds per 100 pounds of water
	INSOLUBLE

12.22 SATURATED VAPOR PRESSURE	
Temperature (degrees F)	Pounds per square inch
	NOT PERTINENT

12.23 SATURATED VAPOR DENSITY	
Temperature (degrees F)	Pounds per cubic foot
	NOT PERTINENT

12.24 IDEAL GAS HEAT CAPACITY	
Temperature (degrees F)	British thermal unit per pound-F
	NOT PERTINENT

ARSENIC

ARX

Common Synonyms	Solid crystals Gray
Arsenic, solid Arsenic, metallic Gray arsenic	Sinks in water.

AVOID CONTACT WITH SOLID AND DUST. KEEP PEOPLE AWAY.
Wear self-contained positive pressure breathing apparatus and full protective clothing.
Stay upwind and use water spray to knock down dust.
Stop discharge if possible.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

Can be heated to burn in air.
POISONOUS GASES ARE PRODUCED IN FIRE.
Wear self-contained positive pressure breathing apparatus and full protective clothing.
Extinguish small fires: dry chemical, carbon dioxide, water spray or foam; large fires: water spray, fog or foam.

Exposure

CALL FOR MEDICAL AID.

DUST
POISONOUS IF INHALED.
Move victim to fresh air.
IF IN EYES OR ON SKIN, immediately flush with running water for at least 15 minutes; hold eyelids open if necessary.
If breathing has stopped, give artificial respiration.
If breathing is difficult, give oxygen.

SOLID
POISONOUS IF SWALLOWED.
IF IN EYES OR ON SKIN, flush with running water for at least 15 minutes; hold eyelids open if necessary.
IF SWALLOWED and victim is CONSCIOUS and has not vomited, induce vomiting with syrup of ipecac.
IF SWALLOWED and victim is UNCONSCIOUS OR HAVING CONVULSIONS, do nothing except keep victim warm.

Water Pollution

Effects of low concentrations on aquatic life is unknown.
May be dangerous if it enters water intakes.
Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

Issue warning - poison.
Restrict access.
Should be removed.
Chemical and physical treatment.

2. LABEL

2.1 **Category:** Poison
2.2 **Class:** 6

3. CHEMICAL DESIGNATIONS

3.1 **CG Compatibility Class:** Not listed
3.2 **Formula:** As
3.3 **IMO/UN Designation:** 6.1/1558
3.4 **DOT ID No.:** 1558
3.5 **CAS Registry No.:** 7440-38-2

4. OBSERVABLE CHARACTERISTICS

4.1 **Physical State (as shipped):** Solid
4.2 **Color:** Silver-gray
4.3 **Odor:** Data not available

5. HEALTH HAZARDS

5.1 **Personal Protective Equipment:** Wear self-contained positive pressure breathing apparatus and full protective clothing.
5.2 **Symptoms Following Exposure:** Poisonous by inhalation of dust or by ingestion. Regardless of exposure route, symptoms in most cases are characteristic of severe gastritis or gastroenteritis. All chemical forms of arsenic eventually produce similar toxic effects. Symptoms may be delayed.
5.3 **Treatment of Exposure:** Get medical attention after any exposure to this metal. INHALATION: Move victim to fresh air. If breathing has stopped, give artificial respiration. If breathing is difficult, give oxygen. EYES OR SKIN: Immediately flush with running water for at least 15 minutes; hold eyelids open if appropriate. Use soap and water to clean skin. Remove and isolate contaminated clothing and shoes. INGESTION: If the victim is alert and has not vomited, induce vomiting with syrup of ipecac.
5.4 **Threshold Limit Value:** 0.2 mg/m³
5.5 **Short Term Inhalation Limits:** Data not available
5.6 **Toxicity by Ingestion:** Data not available
5.7 **Late Toxicity:** Human carcinogen. Causes mutagenic, reproductive and tumorigenic effects along with damage to the gastrointestinal tract and degeneration of the liver and kidneys.
5.8 **Vapor (Gas) Irritant Characteristics:** Data not available
5.9 **Liquid or Solid Irritant Characteristics:** Data not available
5.10 **Odor Threshold:** Data not available
5.11 **IDLH Value:** Data not available

6. FIRE HAZARDS

6.1 **Flash Point:** Not pertinent
6.2 **Flammable Limits in Air:** Not pertinent
6.3 **Fire Extinguishing Agents:** Small fires: dry chemical, carbon dioxide, water spray or foam; large fires: water spray, fog or foam.
6.4 **Fire Extinguishing Agents Not to be Used:** Not pertinent
6.5 **Special Hazards of Combustion Products:** Contain highly toxic arsenic trioxide and other forms of arsenic. Arsenic gas, the most dangerous form of arsenic, is produced upon contact with an acid or acid fumes.
6.6 **Behavior in Fire:** Burns to produce dense white fumes of highly toxic arsenic trioxide.
6.7 **Ignition Temperature:** Not pertinent
6.8 **Electrical Hazard:** Data not available

(Continued)

7. CHEMICAL REACTIVITY

7.1 **Reactivity With Water:** No reaction
7.2 **Reactivity with Common Materials:** Incompatible with zinc.
7.3 **Stability During Transport:** Stable
7.4 **Neutralizing Agents for Acids and Caustics:** Not pertinent
7.5 **Polymerization:** Not pertinent
7.6 **Inhibitor of Polymerization:** Not pertinent
7.7 **Molar Ratio (Reactant to Product):** Data not available
7.8 **Reactivity Group:** Data not available

8. WATER POLLUTION

8.1 **Aquatic Toxicity:** Data not available
8.2 **Waterfowl Toxicity:** Data not available
8.3 **Biological Oxygen Demand (BOD):** None
8.4 **Food Chain Concentration Potential:** Bioaccumulated by fresh water and marine aquatic organisms.

9. SHIPPING INFORMATION

9.1 **Grades of Purity:** Crude, 90-95%; Refined, 99%; Semiconductor, 99.999%
9.2 **Storage Temperature:** Ambient
9.3 **Inert Atmosphere:** Not listed
9.4 **Venting:** Not pertinent

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

II

11. HAZARD CLASSIFICATIONS

11.1 **Code of Federal Regulations:** Poison: B
11.2 **NAS Hazard Rating for Bulk Water Transportation:** Not listed
11.3 **NFPA Hazard Classification:**

Category	Classification
Health Hazard (Blue)	3
Flammability (Red)	2
Reactivity (Yellow)	0

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 **Physical State at 15°C and 1 atm:** Solid
12.2 **Molecular Weight:** 74.9216
12.3 **Boiling Point at 1 atm:** 1,135°F = 613°C = 886°K (sublimes)
12.4 **Freezing Point:** Not pertinent
12.5 **Critical Temperature:** 1477.4°F = 803°C = 1076.2°K
12.6 **Critical Pressure:** 5027.4 psia = 342.0 atm = 34.6 MN/m²
12.7 **Specific Gravity:** 5.727 at 25°C (solid)
12.8 **Liquid Surface Tension:** Not pertinent
12.9 **Liquid Water Interfacial Tension:** Not pertinent
12.10 **Vapor (Gas) Specific Gravity:** Not pertinent
12.11 **Ratio of Specific Heats of Vapor (Gas):** Not pertinent
12.12 **Latent Heat of Vaporization:** Not pertinent
12.13 **Heat of Combustion:** Not pertinent
12.14 **Heat of Decomposition:** Not pertinent
12.15 **Heat of Solution:** Not pertinent
12.16 **Heat of Polymerization:** Not pertinent
12.25 **Heat of Fusion:** Data not available
12.26 **Limiting Value:** Data not available
12.27 **Reid Vapor Pressure:** Data not available

6. FIRE HAZARDS (Continued)

6.9 **Burning Rate:** Not pertinent
6.10 **Adiabatic Flame Temperature:** Data not available
6.11 **Stoichiometric Air to Fuel Ratio:** Data not available
6.12 **Flame Temperature:** Data not available

ARSENIC

12.17 SATURATED LIQUID DENSITY		12.18 LIQUID HEAT CAPACITY		12.19 LIQUID THERMAL CONDUCTIVITY		12.20 LIQUID VISCOSITY	
Temperature (degrees F)	Pounds per cubic foot	Temperature (degrees F)	British thermal unit per pound-F	Temperature (degrees F)	British thermal unit-inch per hour-square foot-F	Temperature (degrees F)	Centipoise
	NOT PERTINENT		NOT PERTINENT		NOT PERTINENT		NOT PERTINENT

12.21 SOLUBILITY IN WATER		12.22 SATURATED VAPOR PRESSURE		12.23 SATURATED VAPOR DENSITY		12.24 IDEAL GAS HEAT CAPACITY	
Temperature (degrees F)	Pounds per 100 pounds of water	Temperature (degrees F)	Pounds per square inch	Temperature (degrees F)	Pounds per cubic foot	Temperature (degrees F)	British thermal unit per pound-F
	INSOLUBLE		NOT PERTINENT		NOT PERTINENT		NOT PERTINENT

BENZENE

BNZ

Common Synonyms	Watery liquid	Colorless	Gasoline-like odor
Benzol Benzole	Floats on water. Flammable, irritating vapor is produced. Freezing point is 42°F		

Avoid contact with liquid and vapor. Keep people away.
Wear goggles and self-contained breathing apparatus.
Shut off ignition sources and call fire department.
Stop discharge if possible.
Stay upwind and use water spray to knock down vapor.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

FLAMMABLE.
Flashback along vapor trail may occur.
Vapor may explode if ignited in an enclosed area.
Wear goggles and self-contained breathing apparatus.
Extinguish with dry chemical, foam, or carbon dioxide.
Water may be ineffective on fire.
Cool exposed containers with water.

Exposure

CALL FOR MEDICAL AID.

VAPOR
Irritating to eyes, nose and throat.
If inhaled, will cause headache, difficult breathing, or loss of consciousness.
Move to fresh air.
If breathing has stopped, give artificial respiration.
If breathing is difficult, give oxygen.

LIQUID
Irritating to skin and eyes.
Harmful if swallowed.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.

Water Pollution

HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS.
May be dangerous if it enters water intakes.
Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

Issue warning-high flammability
Restrict access

2. LABEL

2.1 Category: Flammable liquid
2.2 Class: 3

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Aromatic Hydrocarbon
3.2 Formula: C_6H_6
3.3 IMO/UN Designation: 3.2/1114
3.4 DOT ID No.: 1114
3.5 CAS Registry No.: 71-43-2

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Liquid
4.2 Color: Colorless
4.3 Odor: Aromatic; rather pleasant aromatic odor; characteristic odor

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Hydrocarbon vapor canister, supplied air or a hose mask; *hydrocarbon-insoluble rubber or plastic gloves; chemical goggles or face splash shield;* hydrocarbon-insoluble apron such as neoprene.
5.2 Symptoms Following Exposure: Dizziness, excitation, pallor, followed by flushing, weakness, headache, breathlessness, chest constriction. Coma and possible death.
5.3 Treatment of Exposure: SKIN: flush with water followed by soap and water; remove contaminated clothing and wash skin. EYES: flush with plenty of water until irritation subsides. INHALATION: remove from exposure immediately. Call a physician. IF breathing is irregular or stopped, *start resuscitation, administer oxygen.*
5.4 Threshold Limit Value: 10 ppm
5.5 Short Term Inhalation Limits: 75 ppm for 30 min.
5.6 Toxicity by Ingestion: Grade 3; LD_{50} = 50 to 500 mg/kg
5.7 Late Toxicity: Leukemia
5.8 Vapor (Gas) Irritant Characteristics: If present in high concentrations, vapors may cause irritation of eyes or respiratory system. The effect is temporary.
5.9 *Liquid or Solid Irritant Characteristics:* *Minimum hazard. If spilled on clothing and allowed to* remain, may cause smarting and reddening of the skin.
5.10 Odor Threshold: 4.68 ppm
5.11 IDLH Value: 2,000 ppm

6. FIRE HAZARDS

6.1 Flash Point: 12°F C.C.
6.2 Flammable Limits in Air: 1.3%-7.9%
6.3 Fire Extinguishing Agents: Dry chemical, foam, or carbon dioxide
6.4 Fire Extinguishing Agents Not to be Used: Water may be ineffective
6.5 Special Hazards of Combustion Products: Not pertinent
6.6 Behavior in Fire: Vapor is heavier than air and may travel considerable distance to a *source of ignition and flash back*
6.7 Ignition Temperature: 1097°F
6.8 Electrical Hazard: Class I, Group D
6.9 Burning Rate: 6.0 mm/min.
6.10 Adiabatic Flame Temperature: Data not available
6.11 Stoichiometric Air to Fuel Ratio: *Data not available*
6.12 Flame Temperature: Data not available

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: No reaction
7.2 Reactivity with Common Materials: No reaction
7.3 Stability During Transport: Stable
7.4 Neutralizing Agents for Acids and Caustics: Not pertinent
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Molar Ratio (Reactant to Product): Data not available
7.8 Reactivity Group: 32

8. WATER POLLUTION

8.1 Aquatic Toxicity:
5 ppm/6 hr/minnow/lethal/distilled water
20 ppm/24 hr/sunfish/TL_m/tap water
8.2 Waterfowl Toxicity: Data not available
8.3 Biological Oxygen Demand (BOD):
1.2 lb/lb, 10 days
8.4 Food Chain Concentration Potential:
None

9. SHIPPING INFORMATION

9.1 Grades of Purity:
Industrial pure .....99 + %
Thiophene-free .....99 + %
Nitration .....99 + %
Industrial 90% .....85 + %
Reagent ..... 99 + %
9.2 Storage Temperature: Open
9.3 Inert Atmosphere: No requirement
9.4 Venting: *Pressure-vacuum*

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

A-T-U-V-W

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations:
Flammable liquid
11.2 NAS Hazard Rating for Bulk Water Transportation:

Category	Rating
Fire	3
Health	
Vapor Irritant	1
Liquid or Solid Irritant	1
Poisons	3
Water Pollution	
Human Toxicity	3
Aquatic Toxicity	1
Aesthetic Effect	3
Reactivity	
Other Chemicals	2
Water	1
Self Reaction	0

11.3 NFPA Hazard Classification:

Category	Classification
Health Hazard (Blue)	2
Flammability (Red)	3
Reactivity (Yellow)	0

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 *Physical State at 15°C and 1 atm:*
Liquid
12.2 Molecular Weight: 78.11
12.3 Boiling Point at 1 atm:
176°F = 80.1°C = 353.3°K
12.4 Freezing Point:
42.0°F = 5.5°C = 278.7°K
12.5 Critical Temperature:
552.0°F = 288.9°C = 562.1°K
12.6 Critical Pressure:
710 psia = 48.3 atm = 4.89 MN/m²
12.7 Specific Gravity:
0.879 at 20°C (liquid)
12.8 Liquid Surface Tension:
28.9 dynes/cm = 0.0289 N/m at 20°C
12.9 Liquid Water Interfacial Tension:
35.0 dynes/cm = 0.035 N/m at 20°C
12.10 Vapor (Gas) Specific Gravity: 2.7
12.11 Ratio of Specific Heats of Vapor (Gas):
1.061
12.12 Latent Heat of Vaporization:
169 Btu/lb = 94.1 cal/g = 3.94 X 10^5 J/kg
12.13 Heat of Combustion: −17,460 Btu/lb = −9698 cal/g = −406.0 X 10^5 J/kg
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: Not pertinent
12.16 Heat of Polymerization: Not pertinent
12.25 Heat of Fusion: 30.45 cal/g
12.26 Limiting Value: Data not available
12.27 Reid Vapor Pressure: 3.22 psia

NOTES

BNZ

BENZENE

12.17 SATURATED LIQUID DENSITY

Temperature (degrees F)	Pounds per cubic foot
55	55.330
60	55.140
65	54.960
70	54.770
75	54.580
80	54.400
85	54.210
90	54.030
95	53.840
100	53.660
105	53.470
110	53.290
115	53.100
120	52.920
125	52.730
130	52.540
135	52.360
140	52.170
145	51.990
150	51.800
155	51.620
160	51.430
165	51.250
170	51.060
175	50.870

12.18 LIQUID HEAT CAPACITY

Temperature (degrees F)	British thermal unit per pound-F
45	.394
50	.396
55	.398
60	.400
65	.403
70	.405
75	.407
80	.409
85	.411
90	.414
95	.416
100	.418

12.19 LIQUID THERMAL CONDUCTIVITY

Temperature (degrees F)	British thermal unit-inch per hour-square foot-F
75	.988
80	.981
85	.975
90	.969
95	.962
100	.956
105	.950
110	.944
115	.937
120	.931
125	.925
130	.919
135	.912
140	.906
145	.900
150	.893
155	.887
160	.881
165	.875
170	.868

12.20 LIQUID VISCOSITY

Temperature (degrees F)	Centipoise
55	.724
60	.693
65	.665
70	.638
75	.612
80	.588
85	.566
90	.544
95	.524
100	.505
105	.487
110	.470
115	.453
120	.438

12.21 SOLUBILITY IN WATER

Temperature (degrees F)	Pounds per 100 pounds of water
77.02	.180

12.22 SATURATED VAPOR PRESSURE

Temperature (degrees F)	Pounds per square inch
50	.881
60	1.171
70	1.535
80	1.989
90	2.547
100	3.227
110	4.049
120	5.033
130	6.201
140	7.577
150	9.187
160	11.060
170	13.220
180	15.700
190	18.520
200	21.740
210	25.360

12.23 SATURATED VAPOR DENSITY

Temperature (degrees F)	Pounds per cubic foot
50	.01258
60	.01639
70	.02109
80	.02681
90	.03371
100	.04196
110	.05172
120	.06317
130	.07652
140	.09194
150	.10960
160	.12980
170	.15270
180	.17850
190	.20750
200	.23970
210	.27560

12.24 IDEAL GAS HEAT CAPACITY

Temperature (degrees F)	British thermal unit per pound-F
0	.204
25	.219
50	.234
75	.248
100	.261
125	.275
150	.288
175	.301
200	.313
225	.325
250	.337
275	.349
300	.360
325	.371
350	.381
375	.392
400	.402
425	.412
450	.421
475	.431
500	.440
525	.449
550	.457
575	.465
600	.474

BERYLLIUM

BEM

Common Synonyms	Solid	Silver color	Odorless
	Sinks in water		

AVOID CONTACT WITH SOLID AND DUST. KEEP PEOPLE AWAY
Wear dust respirator and rubber overclothing (including gloves).
Stop discharge if possible.
Call fire department.
Isolate and remove discharged material
Notify local health and pollution control agencies

Fire

Combustible.
POISONOUS GASES MAY BE PRODUCED IN FIRE.
Dust cloud may explode if ignited in an enclosed area.
Wear goggles and self-contained breathing apparatus
Extinguish with dry graphite, soda ash, or other inert powder
DO NOT USE WATER ON FIRE.

Exposure

CALL FOR MEDICAL AID

DUST
POISONOUS IF INHALED OR IF SKIN IS EXPOSED.
If inhaled will cause coughing or difficult breathing.
If in eyes, hold eyelids open and flush with plenty of water
If breathing has stopped, give artificial respiration
If breathing is difficult, give oxygen

SOLID
POISONOUS IF SWALLOWED OR IF SKIN IS EXPOSED.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk and have victim induce vomiting
IF SWALLOWED and victim is UNCONSCIOUS OR HAVING CONVULSIONS, do nothing except keep victim warm.

Water Pollution

Effect of low concentrations on aquatic life is unknown.
May be dangerous if it enters water intakes.
Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

Issue warning-poison, water contaminant
Restrict access
Should be removed
Chemical and physical treatment

2. LABEL

2.1 Category: None
2.2 Class: Not pertinent

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Not listed
3.2 Formula: Be
3.3 IMO/UN Designation: 6.1/1567
3.4 DOT ID No.: 1567
3.5 CAS Registry No.: 7440-41-7

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Solid
4.2 Color: White
4.3 Odor: None

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Bu. Mines approved respirator; clean work clothes daily; gloves; eye protection

5.2 Symptoms Following Exposure: Any dramatic, unexplained weight loss should be considered as possible first indication of beryllium disease. Dust is extremely toxic when inhaled; symptoms include coughing, shortness of breath, and acute or chronic lung disease. There is no record of illness from ingestion of beryllium. Contact with dust causes conjunctival inflammation of eyes and dermatitis.

5.3 Treatment of Exposure: INHALATION: acute disease may require hospitalization with administration of oxygen; chest x-ray should be taken immediately. EYES: flush with water for at least 15 min. SKIN: flush with water; wash with soap and water; all cuts, scratches or other injuries should receive prompt medical attention.

5.4 Threshold Limit Value: 0.002 mg/m³

5.5 Short Term Inhalation Limits: 0.025 mg/m³, less than 30 min.

5.6 Toxicity by Ingestion: Grade 3; oral LD_{50} = 100 mg/kg (mouse)

5.7 Late Toxicity: Berylliosis of lungs may occur from 3 months to 15 years after exposure. Chronic systemic diseases of the liver, spleen, lymph nodes, bone, kidney, and other organs may also occur.

5.8 Vapor (Gas) Irritant Characteristics: Data not available

5.9 *Liquid or Solid Irritant Characteristics:* *Data not available*

5.10 Odor Threshold: Odorless

5.11 IDLH Value: Data not available

6. FIRE HAZARDS

6.1 Flash Point: Not pertinent
6.2 Flammable Limits in Air: Not pertinent
6.3 Fire Extinguishing Agents: Graphite, sand, or any other inert dry powder
6.4 Fire Extinguishing Agents Not to be Used: Water
6.5 Special Hazards of Combustion Products: Combustion yields beryllium oxide fume, which is toxic if inhaled.
6.6 Behavior in Fire: Powder may form explosive mixture with air.
6.7 Ignition Temperature: Not pertinent
6.8 Electrical Hazard: Not pertinent
6.9 Burning Rate: Not pertinent
6.10 Adiabatic Flame Temperature: Data not available
6.11 Stoichiometric Air to Fuel Ratio: *Data not available*
6.12 Flame Temperature: Data not available

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: No reaction
7.2 Reactivity with Common Materials: Data not available
7.3 Stability During Transport: Stable
7.4 Neutralizing Agents for Acids and Caustics: Not pertinent
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Molar Ratio (Reactant to Product): Data not available
7.8 Reactivity Group: Data not available

8. WATER POLLUTION

8.1 Aquatic Toxicity: Data not available
8.2 Waterfowl Toxicity: Data not available
8.3 Biological Oxygen Demand (BOD): Data not available
8.4 Food Chain Concentration Potential: Data not available

9. SHIPPING INFORMATION

9.1 Grades of Purity: Grade AA, 99.96+%; Grade A, 99.87+%; Nuclear grade
9.2 Storage Temperature: Ambient
9.3 Inert Atmosphere: No requirement
9.4 Venting: Open

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

II

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: Not listed
11.2 NAS Hazard Rating for Bulk Water Transportation: Not listed
11.3 NFPA Hazard Classification:

Category	Classification*
Health Hazard (Blue)	4
Flammability (Red)	1
Reactivity (Yellow)	0

*Applies to dust or powder

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Solid
12.2 Molecular Weight: 9.01
12.3 Boiling Point at 1 atm: Not pertinent
12.4 Freezing Point: Not pertinent
12.5 Critical Temperature: Not pertinent
12.6 Critical Pressure: Not pertinent
12.7 Specific Gravity: 1.85 at 20°C (solid)
12.8 Liquid Surface Tension: Not pertinent
12.9 Liquid Water Interfacial Tension: Not pertinent
12.10 Vapor (Gas) Specific Gravity: Not pertinent
12.11 Ratio of Specific Heats of Vapor (Gas): Not pertinent
12.12 Latent Heat of Vaporization: Not pertinent
12.13 Heat of Combustion: −28,000 Btu/lb = −15,560 cal/g = -652×10^3 J/kg
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: Not pertinent
12.16 Heat of Polymerization: Not pertinent
12.25 Heat of Fusion: 260.0 cal/g
12.26 Limiting Value: Data not available
12.27 *Reid Vapor Pressure:* *Data not available*

NOTES

BERYLLIUM

12.17 SATURATED LIQUID DENSITY		12.18 LIQUID HEAT CAPACITY		12.19 LIQUID THERMAL CONDUCTIVITY		12.20 LIQUID VISCOSITY	
Temperature (degrees F)	Pounds per cubic foot	Temperature (degrees F)	British thermal unit per pound-F	Temperature (degrees F)	British thermal unit-inch per hour-square foot-F	Temperature (degrees F)	Centipoise
	NOT PERTINENT		NOT PERTINENT		NOT PERTINENT		NOT PERTINENT

12.21 SOLUBILITY IN WATER		12.22 SATURATED VAPOR PRESSURE		12.23 SATURATED VAPOR DENSITY		12.24 IDEAL GAS HEAT CAPACITY	
Temperature (degrees F)	Pounds per 100 pounds of water	Temperature (degrees F)	Pounds per square inch	Temperature (degrees F)	Pounds per cubic foot	Temperature (degrees F)	British thermal unit per pound-F
	INSOLUBLE		NOT PERTINENT		NOT PERTINENT		NOT PERTINENT

DDD

DDD

Common Synonyms	Solid	White
TDE 1,1-Dichloro-2,2-bis(p-chloro-phenyl) ethane Dichlorodiphenyldichloro ethane	Sinks in water.	

Stop discharge if possible. Keep people away.
Avoid contact with solid and dust.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

Combustible
Irritating gases may be produced when heated.
Wear goggles and self-contained breathing apparatus.
Extinguish with water. Dry chemicals, foam, or carbon dioxide.

Exposure

CALL FOR MEDICAL AID.

DUST
Irritating to eyes, nose and throat.
Harmful if inhaled.
IF IN EYES, hold eyelids open and flush with plenty of water.
If breathing has stopped, give artificial respiration.
If breathing is difficult, give oxygen.

SOLID
Irritating to skin and eyes.
Harmful if swallowed.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim rinse mouth and drink water.
IF SWALLOWED and victim is UNCONSCIOUS OR HAVING CONVULSIONS, do nothing except keep victim warm.

Water Pollution

HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS.
May be dangerous if it enters water intakes.
Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)
Issue warning-water contaminatn
Should be removed
Chemical and physical treatment

2. LABEL

2.1 Category: None
2.2 Class: Not pertinent

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Not listed
3.2 Formula: $(4\text{-}ClC_6H_4)_2CH\text{-}CHCl_2$
3.3 IMO/UN Designation: Not listed
3.4 DOT ID No.: 2761
3.5 CAS Registry No.: 72-54-8

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Solid
4.2 Color: White
4.3 Odor: Data not available

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Dust mask; goggles or face shield; rubber gloves
5.2 Symptoms Following Exposure: Ingestion causes vomiting and delayed symptoms similar to those caused by DDT. Contact with eyes causes irritation.
5.3 Treatment of Exposure: INGESTION: treatment should be given by a physician and is similar to that given following ingestion of DDT. EYES: flush with water.
5.4 Threshold Limit Value: Data not available
5.5 Short Term Inhalation Limits: Data not available
5.6 Toxicity by Ingestion: Grade 2, oral LD_{50} 1.2 g/kg (mouse), 3.4 g/kg (rat)
5.7 Late Toxicity: Data not available
5.8 Vapor (Gas) Irritant Characteristics: Data not available
5.9 Liquid or Solid Irritant Characteristics: Data not available
5.10 Odor Threshold: Data not available
5.11 IDLH Value: Data not available

6. FIRE HAZARDS

6.1 Flash Point: Not pertinent
6.2 Flammable Limits in Air: Not pertinent
6.3 Fire Extinguishing Agents: Water, foam, dry chemical, carbon dioxide
6.4 Fire Extinguishing Agents Not to be Used: Data not available
6.5 Special Hazards of Combustion Products: Irritating hydrogen chloride fumes may form in fires
6.6 Behavior in Fire: Data not available
6.7 Ignition Temperature: Data not available
6.8 Electrical Hazard: Not pertinent
6.9 Burning Rate: Not pertinent
6.10 Adiabatic Flame Temperature: Data not available
6.11 Stoichiometric Air to Fuel Ratio: Data not available
6.12 Flame Temperature: Data not available

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: No reaction
7.2 Reactivity with Common Materials: Data not available
7.3 Stability During Transport: Stable
7.4 Neutralizing Agents for Acids and Caustics: Not pertinent
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Molar Ratio (Reactant to Product): Data not available
7.8 Reactivity Group: Data not available

8. WATER POLLUTION

8.1 Aquatic Toxicity:
<2.6 ppm/96 hr/catfish/TL_m/fresh water
0.15-0.2 ppm/48 hr/brown shrimp/TL_m/salt water
0.0068 ppm/24 hr/brown shrimp/LC_{50}/salt water
8.2 Waterfowl Toxicity: 4,800-5,200 ppm LC_{50}
8.3 Biological Oxygen Demand (BOD): Data not available
8.4 Food Chain Concentration Potential: High

9. SHIPPING INFORMATION

9.1 Grades of Purity: Technical
9.2 Storage Temperature: Ambient
9.3 Inert Atmosphere: No requirement
9.4 Venting: Open

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)
II

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: Not listed
11.2 NAS Hazard Rating for Bulk Water Transportation: Not listed
11.3 NFPA Hazard Classification: Not listed

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Solid
12.2 Molecular Weight: 320
12.3 Boiling Point at 1 atm: Not pertinent (decomposes)
12.4 Freezing Point: 234°F 112°C 385°K
12.5 Critical Temperature: Not pertinent
12.6 Critical Pressure: Not pertinent
12.7 Specific Gravity: 1.476 at 20°C (solid)
12.8 Liquid Surface Tension: Not pertinent
12.9 Liquid Water Interfacial Tension: Not pertinent
12.10 Vapor (Gas) Specific Gravity: Not pertinent
12.11 Ratio of Specific Heats of Vapor (Gas): Not pertinent
12.12 Latent Heat of Vaporization: Not pertinent
12.13 Heat of Combustion: Data not available
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: Not pertinent
12.16 Heat of Polymerization: Not pertinent
12.25 Heat of Fusion: Data not available
12.26 Limiting Value: Data not available
12.27 Reid Vapor Pressure: Data not available

NOTES

DDD

12.17 SATURATED LIQUID DENSITY		12.18 LIQUID HEAT CAPACITY		12.19 LIQUID THERMAL CONDUCTIVITY		12.20 LIQUID VISCOSITY	
Temperature (degrees F)	Pounds per cubic foot	Temperature (degrees F)	British thermal unit per pound-F	Temperature (degrees F)	British thermal unit-inch per hour-square foot-F	Temperature (degrees F)	Centipoise
	NOT PERTINENT		NOT PERTINENT		NOT PERTINENT		NOT PERTINENT

12.21 SOLUBILITY IN WATER		12.22 SATURATED VAPOR PRESSURE		12.23 SATURATED VAPOR DENSITY		12.24 IDEAL GAS HEAT CAPACITY	
Temperature (degrees F)	Pounds per 100 pounds of water	Temperature (degrees F)	Pounds per square inch	Temperature (degrees F)	Pounds per cubic foot	Temperature (degrees F)	British thermal unit per pound-F
	NOT PERTINENT		NOT PERTINENT		NOT PERTINENT		NOT PERTINENT

ETHYLBENZENE

ETB

Common Synonyms	Liquid	Colorless	Sweet, gasoline-like odor
Phenylethane EB	Floats on water. Flammable, irritating vapor is produced.		

Avoid contact with liquid and vapor. Keep people away.
Wear goggles, self-contained breathing apparatus, and rubber overclothing (including gloves).
Shut off ignition sources and call fire department.
Stop discharge if possible.
Stay upwind and use water spray to "knock down" vapor.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

FLAMMABLE.
Flashback along vapor trail may occur.
Vapor may explode if ignited in an enclosed area.
Wear goggles, self-contained breathing apparatus, and rubber overclothing (including gloves).
Extinguish with dry chemical, foam, or carbon dioxide.
Water may be ineffective on fire.
Cool exposed containers with water.

Exposure

CALL FOR MEDICAL AID.

VAPOR
Irritating to eyes, nose and throat.
If inhaled, will cause dizziness or difficult breathing.
Move to fresh air.
If breathing has stopped, give artificial respiration.
If breathing is difficult, give oxygen.

LIQUID
Will burn skin and eyes.
Harmful if swallowed.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.
DO NOT INDUCE VOMITING.

Water Pollution

HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS.
Fouling to shoreline.
May be dangerous if it enters water intakes.
Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

Mechanical containment
Should be removed
Chemical and physical treatment

2. LABEL

2.1 **Category:** Flammable liquid
2.2 **Class:** 3

3. CHEMICAL DESIGNATIONS

3.1 **CG Compatibility Class:** Aromatic hydrocarbon
3.2 **Formula:** $C_6H_5CH_2CH_3$
3.3 **IMO/UN Designation:** 3.3/1175
3.4 **DOT ID No.:** 1175
3.5 **CAS Registry No.:** 100-41-4

4. OBSERVABLE CHARACTERISTICS

4.1 **Physical State (as shipped):** Liquid
4.2 **Color:** Colorless
4.3 **Odor:** Aromatic

5. HEALTH HAZARDS

5.1 **Personal Protective Equipment:** Self-contained breathing apparatus; safety goggles.
5.2 **Symptoms Following Exposure:** Inhalation may cause irritation of nose, dizziness, depression. Moderate irritation of eye with corneal injury possible. Irritates skin and may cause blisters.
5.3 **Treatment of Exposure:** INHALATION: if ill effects occur, remove victim to fresh air, keep him warm and quiet, and get medical help promptly; if breathing stops, give artificial respiration. INGESTION: induce vomiting only upon physician's approval; material in lung may cause chemical pneumonia. SKIN AND EYES: promptly flush with plenty of water (15 min. for eyes) and get medical attention; remove and wash contaminated clothing before reuse.
5.4 **Threshold Limit Value:** 100 ppm
5.5 **Short Term Inhalation Limits:** 200 ppm for 30 min.
5.6 **Toxicity by Ingestion:** Grade 2; LD_{50} = 0.5 to 5 g/kg (rat)
5.7 **Late Toxicity:** Data not available
5.8 **Vapor (Gas) Irritant Characteristics:** Vapors cause moderate irritation such that personnel will find high concentrations unpleasant. The effect is temporary.
5.9 **Liquid or Solid Irritant Characteristics:** Causes smarting of the skin and first-degree burns on short exposure; may cause secondary burns on long exposure.
5.10 **Odor Threshold:** 140 ppm
5.11 **IDLH Value:** 2,000 ppm

6. FIRE HAZARDS

6.1 **Flash Point:** 80°F O.C.; 59°F C.C.
6.2 **Flammable Limits in Air:** 1.0%-6.7%
6.3 **Fire Extinguishing Agents:** Foam (most effective), water fog, carbon dioxide or dry chemical.
6.4 **Fire Extinguishing Agents Not to be Used:** Not pertinent
6.5 **Special Hazards of Combustion Products:** Irritating vapors are generated when heated.
6.6 **Behavior in Fire:** Vapor is heavier than air and may travel considerable distance to the source of ignition and flash back.
6.7 **Ignition Temperature:** 860°F
6.8 **Electrical Hazard:** Not pertinent
6.9 **Burning Rate:** 5.8 mm/min.
6.10 **Adiabatic Flame Temperature:** Data Not Available

(Continued)

7. CHEMICAL REACTIVITY

7.1 **Reactivity With Water:** No reaction
7.2 **Reactivity with Common Materials:** No reaction
7.3 **Stability During Transport:** Stable
7.4 **Neutralizing Agents for Acids and Caustics:** Not pertinent
7.5 **Polymerization:** Not pertinent
7.6 **Inhibitor of Polymerization:** Not pertinent
7.7 **Molar Ratio (Reactant to Product):** Data Not Available
7.8 **Reactivity Group:** 32

8. WATER POLLUTION

8.1 **Aquatic Toxicity:** 29 ppm/96 hr/bluegill/TL_m/fresh water
8.2 **Waterfowl Toxicity:** Data not available
8.3 **Biological Oxygen Demand (BOD):** 2.8% (theor.), 5 days
8.4 **Food Chain Concentration Potential:** None

9. SHIPPING INFORMATION

9.1 **Grades of Purity:** Research grade: 99.98%; pure grade: 99.5%; technical grade: 99.0%
9.2 **Storage Temperature:** Ambient
9.3 **Inert Atmosphere:** No requirement
9.4 **Venting:** Open (flame arrester) or pressure-vacuum

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

A-T-U

11. HAZARD CLASSIFICATIONS

11.1 **Code of Federal Regulations:** Flammable liquid
11.2 **NAS Hazard Rating for Bulk Water Transportation:**

Category	Rating
Fire	3
Health	
Vapor Irritant	2
Liquid or Solid Irritant	2
Poisons	2
Water Pollution	
Human Toxicity	1
Aquatic Toxicity	3
Aesthetic Effect	2
Reactivity	
Other Chemicals	1
Water	0
Self Reaction	0

11.3 **NFPA Hazard Classification:**

Category	Classification
Health Hazard (Blue)	2
Flammability (Red)	3
Reactivity (Yellow)	0

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 **Physical State at 15°C and 1 atm:** Liquid
12.2 **Molecular Weight:** 106.17
12.3 **Boiling Point at 1 atm:** 277.2°F = 136.2°C = 409.4°K
12.4 **Freezing Point:** —139°F = —95°C = 178°K
12.5 **Critical Temperature:** 651.0°F = 343.9°C = 617.1°K
12.6 **Critical Pressure:** 523 psia = 35.6 atm = 3.61 MN/m²
12.7 **Specific Gravity:** 0.867 at 20°C (liquid)
12.8 **Liquid Surface Tension:** 29.2 dynes/cm = 0.0292 N/m at 20°C
12.9 **Liquid Water Interfacial Tension:** 35.48 dynes/cm = 0.03548 N/m at 20°C
12.10 **Vapor (Gas) Specific Gravity:** Not pertinent
12.11 **Ratio of Specific Heats of Vapor (Gas):** 1.071
12.12 **Latent Heat of Vaporization:** 144 Btu/lb = 80.1 cal/g = 3.35 X 10^4 J/kg
12.13 **Heat of Combustion:** —17,780 Btu/lb = —9877 cal/g = —413.5 X 10^5 J/kg
12.14 **Heat of Decomposition:** Not pertinent
12.15 **Heat of Solution:** Not pertinent
12.16 **Heat of Polymerization:** Not pertinent
12.25 **Heat of Fusion:** Data Not Available
12.26 **Limiting Value:** Data Not Available
12.27 **Reid Vapor Pressure:** 0.4 psia

6. FIRE HAZARDS (Continued)

6.11 **Stoichiometric Air to Fuel Ratio:** Data Not Available
6.12 **Flame Temperature:** Data Not Available

ETB

ETHYLBENZENE

12.17 SATURATED LIQUID DENSITY

Temperature (degrees F)	Pounds per cubic foot
40	54.990
50	54.680
60	54.370
70	54.060
80	53.750
90	53.430
100	53.120
110	52.810
120	52.500
130	52.190
140	51.870
150	51.560
160	51.250
170	50.940
180	50.620
190	50.310
200	50.000
210	49.690

12.18 LIQUID HEAT CAPACITY

Temperature (degrees F)	British thermal unit per pound-F
40	.402
50	.404
60	.407
70	.409
80	.412
90	.414
100	.417
110	.419
120	.421
130	.424
140	.426
150	.429
160	.431
170	.434
180	.436
190	.439
200	.441
210	.443

12.19 LIQUID THERMAL CONDUCTIVITY

Temperature (degrees F)	British thermal unit-inch per hour-square foot-F
—90	1.065
—80	1.056
—70	1.047
—60	1.037
—50	1.028
—40	1.018
—30	1.009
—20	1.000
—10	.990
0	.981
10	.971
20	.962
30	.953
40	.943
50	.934
60	.924
70	.915
80	.906
90	.896
100	.887
110	.877
120	.868
130	.859
140	.849
150	.840
160	.830

12.20 LIQUID VISCOSITY

Temperature (degrees F)	Centipoise
40	.835
50	.774
60	.719
70	.670
80	.626
90	.586
100	.550
110	.518
120	.488
130	.461
140	.436
150	.414
160	.393
170	.374
180	.356
190	.340
200	.325
210	.311

12.21 SOLUBILITY IN WATER

Temperature (degrees F)	Pounds per 100 pounds of water
68.02	.020

12.22 SATURATED VAPOR PRESSURE

Temperature (degrees F)	Pounds per square inch
80	.202
100	.370
120	.644
140	1.071
160	1.713
180	2.643
200	3.953
220	5.747
240	8.147
260	11.290
280	15.320
300	20.410
320	26.730
340	34.460
360	43.800
380	54.950

12.23 SATURATED VAPOR DENSITY

Temperature (degrees F)	Pounds per cubic foot
80	.00370
100	.00654
120	.01099
140	.01767
160	.02734
180	.04087
200	.05926
220	.08363
240	.11520
260	.15510
280	.20490
300	.26570
320	.33910
340	.42620
360	.52850
380	.64720

12.24 IDEAL GAS HEAT CAPACITY

Temperature (degrees F)	British thermal unit per pound-F
—400	—.007
—350	.026
—300	.060
—250	.093
—200	.125
—150	.157
—100	.187
—50	.217
0	.246
50	.274
100	.301
150	.327
200	.353
250	.377
300	.401
350	.424
400	.446
450	.467
500	.487
550	.507
600	.525

MERCURY

MCR

Common Synonyms	Liquid	Silver	Odorless
Quicksilver	*Sinks in water.*		

AVOID CONTACT WITH LIQUID. Keep people away.
Stop discharge if possible.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

Not flammable.

Exposure

CALL FOR MEDICAL AID.

LIQUID
Effects of exposure may be delayed.

Water Pollution

HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS.
May be dangerous if it enters water intakes.
Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

Should be removed
Chemical and physical treatment

2. LABEL

2.1 **Category:** None

3. CHEMICAL DESIGNATIONS

3.1 **CG Compatibility Class:** Not listed
3.2 **Formula:** *Hg*
3.3 **IMO/UN Designation:** Not listed
3.4 **DOT ID No.:** 2809
3.5 **CAS Registry No.:** 7439-97-6

4. OBSERVABLE CHARACTERISTICS

4.1 **Physical State (as shipped):** Liquid
4.2 **Color:** Silvery
4.3 **Odor:** None

5. HEALTH HAZARDS

5.1 **Personal Protective Equipment:** Avoid contact of liquid with skin. For vapor use chemical cartridge (Hopcalite) respirator.
5.2 **Symptoms Following Exposure:** No immediate symptoms. As poisoning becomes established, slight muscular tremor, loss of appetite, nausea, and diarrhea are observed. Psychic, kidney, and cardiovascular disturbances may occur.
5.3 **Treatment of Exposure:** Consult a doctor.
5.4 **Threshold Limit Value:** 0.05 mg/m^3
5.5 **Short Term Inhalation Limits:** Data not available
5.6 **Toxicity by Ingestion:** No immediate toxicity
5.7 **Late Toxicity:** Development of mercury poisoning
5.8 **Vapor (Gas) Irritant Characteristics:** None
5.9 **Liquid or Solid Irritant Characteristics:** None
5.10 **Odor Threshold:** Not pertinent
5.11 **IDLH Value:** 28 mg/m^3

6. FIRE HAZARDS

6.1 **Flash Point:** Not flammable
6.2 **Flammable Limits in Air:** Not flammable
6.3 **Fire Extinguishing Agents:** Not pertinent
6.4 **Fire Extinguishing Agents Not to be Used:** Not pertinent
6.5 **Special Hazards of Combustion Products:** Not pertinent
6.6 **Behavior in Fire:** Not flammable
6.7 **Ignition Temperature:** Not flammable
6.8 **Electrical Hazard:** Not pertinent
6.9 **Burning Rate:** Not flammable
6.10 **Adiabatic Flame Temperature:** Data not available
6.11 **Stoichiometric Air to Fuel Ratio:** Data not available
6.12 **Flame Temperature:** Data not available

7. CHEMICAL REACTIVITY

7.1 **Reactivity With Water:** No reaction
7.2 **Reactivity with Common Materials:** No reaction
7.3 **Stability During Transport:** Stable
7.4 **Neutralizing Agents for Acids and Caustics:** Not pertinent
7.5 **Polymerization:** Not pertinent
7.6 **Inhibitor of Polymerization:** Not pertinent
7.7 **Molar Ratio (Reactant to Product):** Data not available
7.8 **Reactivity Group:** Data not available

8. WATER POLLUTION

8.1 **Aquatic Toxicity:** 0.5-1 ppm/48 hr/*carassius ardium*/TL_m/fresh water
0.29 ppm/48 hr/marine fish/TL_m/salt water
8.2 **Waterfowl Toxicity:** Data not available
8.3 **Biological Oxygen Demand (BOD):** None
8.4 **Food Chain Concentration Potential:** Mercury concentrates in liver and kidneys of ducks and geese to levels above FDA limit of 0.5 ppm. Muscle tissue usually well below the limit.

9. SHIPPING INFORMATION

9.1 **Grades of Purity:** Pure
9.2 **Storage Temperature:** Ambient
9.3 **Inert Atmosphere:** No requirement
9.4 **Venting:** Open

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

A-X

11. HAZARD CLASSIFICATIONS

11.1 **Code of Federal Regulations:** ORM-B
11.2 **NAS Hazard Rating for Bulk Water Transportation:** Not listed
11.3 **NFPA Hazard Classification:** Not listed

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 **Physical State at 15°C and 1 atm:** Liquid
12.2 **Molecular Weight:** 200.59
12.3 **Boiling Point at 1 atm:** 675°F = 357°C = 630°K
12.4 **Freezing Point:** −38.0°F = −38.9°C = 234.3°K
12.5 **Critical Temperature:** 2664°F = 1462°C = 1735°K
12.6 **Critical Pressure:** 23,300 psia = 1587 atm = 160.8 MN/m^3
12.7 **Specific Gravity:** 13.55 at 20°C (liquid)
12.8 **Liquid Surface Tension:** 470 dynes/cm = 0.470 N/m at 20°C
12.9 **Liquid Water Interfacial Tension:** 375 dynes/cm = 0.375 N/m at 20°C
12.10 **Vapor (Gas) Specific Gravity:** Not pertinent
12.11 **Ratio of Specific Heats of Vapor (Gas):** Not pertinent
12.12 **Latent Heat of Vaporization:** Not pertinent
12.13 **Heat of Combustion:** Not pertinent
12.14 **Heat of Decomposition:** Not pertinent
12.15 **Heat of Solution:** Not pertinent
12.16 **Heat of Polymerization:** Not pertinent
12.25 **Heat of Fusion:** 2.7 cal/g
12.26 **Limiting Value:** Data not available
12.27 **Reid Vapor Pressure:** Data not available

NOTES

MERCURY

12.17 SATURATED LIQUID DENSITY

Temperature (degrees F)	Pounds per cubic foot
0	851.399
5	851.000
10	850.500
15	850.099
20	849.699
25	849.199
30	848.799
35	848.399
40	847.899
45	847.500
50	847.099
55	846.599
60	846.199
65	845.799
70	845.299
75	844.899
80	844.500
85	844.000
90	843.599
95	843.199
100	842.699

12.18 LIQUID HEAT CAPACITY

Temperature (degrees F)	British thermal unit per pound-F
35	.033
40	.033
45	.033
50	.033
55	.033
60	.033
65	.033
70	.033
75	.033
80	.033
85	.033
90	.033
95	.033
100	.033

12.19 LIQUID THERMAL CONDUCTIVITY

Temperature (degrees F)	British thermal unit-inch per hour-square foot-F
	NOT PERTINENT

12.20 LIQUID VISCOSITY

Temperature (degrees F)	Centipoise
0	1.827
5	1.801
10	1.777
15	1.754
20	1.731
25	1.709
30	1.688
35	1.668
40	1.648
45	1.629
50	1.610
55	1.592
60	1.575
65	1.558
70	1.541
75	1.525
80	1.510
85	1.495
90	1.480
95	1.466
100	1.452

12.21 SOLUBILITY IN WATER

Temperature (degrees F)	Pounds per 100 pounds of water
	INSOLUBLE

12.22 SATURATED VAPOR PRESSURE

Temperature (degrees F)	Pounds per square inch
	NOT PERTINENT

12.23 SATURATED VAPOR DENSITY

Temperature (degrees F)	Pounds per cubic foot
	NOT PERTINENT

12.24 IDEAL GAS HEAT CAPACITY

Temperature (degrees F)	British thermal unit per pound-F
	NOT PERTINENT

METHOXYCHLOR

MOC

Common Synonyms	Solid	White to light yellow	Mild fruity odor
DMDT Methoxy DDT 2, 2-Bis (p-methoxyphenyl)-1, 1, 1-trichloroethane Marlate 50	Sinks in water.		

AVOID CONTACT WITH SOLID AND DUST. KEEP PEOPLE AWAY.
Wear goggles and dust respirator.
Call fire department.
Stay upwind, use water spray to "knock down" dust.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

Combustible.
POISONOUS GASES MAY BE PRODUCED IN FIRE.
Extinguish with water, dry chemicals, foam, or carbon dioxide.

Exposure

CALL FOR MEDICAL AID.

DUST
POISONOUS IF INHALED.
Move victim to fresh air.
If in eyes, hold eyelids open and flush with plenty of water.
If breathing is difficult, give oxygen.

SOLID
POISONOUS IF SWALLOWED.
Irritating to skin and eyes.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.

Water Pollution

HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS.
May be dangerous if it enters water intakes.
Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

Issue warning-poison, water contaminant
Restrict access
Should be removed
Chemical and physical treatment

2. LABEL

2.1 Category: None
2.2 Class: Not pertinent

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Not listed
3.2 Formula: $C_{16}H_{15}Cl_3O_2$
3.3 IMO/UN Designation: 6.1/2761
3.4 DOT ID No.: 2761
3.5 CAS Registry No.: 72-43-5

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Solid
4.2 Color: Light cream; white to light yellow
4.3 Odor: Slighty fruity

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Dust respirator if needed; gloves and goggles.
5.2 Symptoms Following Exposure: Toxicity is relatively low. Inhalation or ingestion causes generalized depression.
5.3 Treatment of Exposure: EYES: flush with water if irritated. SKIN: wash well with soap and water. INGESTION: consult physician.
5.4 Threshold Limit Value: 10 mg/m³
5.5 Short Term Inhalation Limits: Data not available
5.6 Toxicity by Ingestion: Grade 1; LD_{50} = 5 to 15 g/kg
5.7 Late Toxicity: Data not available
5.8 Vapor (Gas) Irritant Characteristics: Data not available
5.9 Liquid or Solid Irritant Characteristics: Data not available
5.10 Odor Threshold: Not pertinent
5.11 IDLH Value: 7,500 mg/m³

6. FIRE HAZARDS

6.1 Flash Point: Burns only at high temperatures. For liquid forms, see Kerosene.
6.2 Flammable Limits in Air: Not pertinent
6.3 Fire Extinguishing Agents: Water, foam, dry chemical, carbon dioxide.
6.4 Fire Extinguishing Agents Not to be Used: Not pertinent
6.5 Special Hazards of Combustion Products: Irritating and toxic hydrogen chloride gas may be formed in fire.
6.6 Behavior in Fire: Not pertinent
6.7 Ignition Temperature: Not pertinent
6.8 Electrical Hazard: Not pertinent
6.9 Burning Rate: Not pertinent
6.10 Adiabatic Flame Temperature: Data not available

(Continued)

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: No reaction
7.2 Reactivity with Common Materials: No reaction
7.3 Stability During Transport: Stable
7.4 Neutralizing Agents for Acids and Caustics: Not pertinent
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Molar Ratio (Reactant to Product): Data not available
7.8 Reactivity Group: Data not available

8. WATER POLLUTION

8.1 Aquatic Toxicity: 0.035 ppm/96 hr/fathead/TL_m/fresh water
0.004-.012 ppm/96 hr/marine crustacea/TL_m/salt water
8.2 Waterfowl Toxicity: LD_{50} = 2,000 mg/kg
8.3 Biological Oxygen Demand (BOD): Data not available
8.4 Food Chain Concentration Potential: Data not available

9. SHIPPING INFORMATION

9.1 Grades of Purity: Technical flake or chip; 88% plus 12% isomers; Wettable powders: 50-75%; Dust concentrate: 40% Emulsifiable concentrate (liquid): 25% solution in petroleum distillate.
9.2 Storage Temperature: Ambient
9.3 Inert Atmosphere: No requirement
9.4 Venting: Open

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

II

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: ORM-E
11.2 NAS Hazard Rating for Bulk Water Transportation: Not listed
11.3 NFPA Hazard Classification: Not listed

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Solid
12.2 Molecular Weight: 345.7
12.3 Boiling Point at 1 atm: Not pertinent (decomposes)
12.4 Freezing Point: 171—192°F = 77—89°C = 350—362°K
12.5 Critical Temperature: Not pertinent
12.6 Critical Pressure: Not pertinent
12.7 Specific Gravity: 1.41 at 25°C (solid)
12.8 Liquid Surface Tension: Not pertinent
12.9 Liquid Water Interfacial Tension: Not pertinent
12.10 Vapor (Gas) Specific Gravity: Not pertinent
12.11 Ratio of Specific Heats of Vapor (Gas): Not pertinent
12.12 Latent Heat of Vaporization: Not pertinent
12.13 Heat of Combustion: Not pertinent
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: Not pertinent
12.16 Heat of Polymerization: Not pertinent
12.25 Heat of Fusion: Data not available
12.26 Limiting Value: Data not available
12.27 Reid Vapor Pressure: Data not available

6. FIRE HAZARDS (Continued)

6.11 Stoichiometric Air to Fuel Ratio: Data not available
6.12 Flame Temperature: Data not available

METHOXYCHLOR

12.17 SATURATED LIQUID DENSITY		12.18 LIQUID HEAT CAPACITY		12.19 LIQUID THERMAL CONDUCTIVITY		12.20 LIQUID VISCOSITY	
Temperature (degrees F)	Pounds per cubic foot	Temperature (degrees F)	British thermal unit per pound-F	Temperature (degrees F)	British thermal unit-inch per hour-square foot-F	Temperature (degrees F)	Centipoise
	NOT PERTINENT		NOT PERTINENT		NOT PERTINENT		NOT PERTINENT

12.21 SOLUBILITY IN WATER		12.22 SATURATED VAPOR PRESSURE		12.23 SATURATED VAPOR DENSITY		12.24 IDEAL GAS HEAT CAPACITY	
Temperature (degrees F)	Pounds per 100 pounds of water	Temperature (degrees F)	Pounds per square inch	Temperature (degrees F)	Pounds per cubic foot	Temperature (degrees F)	British thermal unit per pound-F
	INSOLUBLE		NOT PERTINENT		NOT PERTINENT		NOT PERTINENT

m-XYLENE

XLM

Common Synonyms

1, 3-Dimethylbenzene
Xylol

Watery liquid Colorless Sweet odor

Floats on water. Flammable, irritating vapor is produced.

Stop discharge if possible. Keep people away.
Call fire department.
Avoid contact with liquid and vapor.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

FLAMMABLE
Flashback along vapor trail may occur.
Vapor may explode if ignited in an enclosed area.

Wear self-contained breathing apparatus.
Extinguish with foam, dry chemical, or carbon dioxide.
Water may be ineffective on fire.
Cool exposed containers with water.

Exposure

CALL FOR MEDICAL AID.

VAPOR
Irritating to eyes, nose, and throat.
If inhaled, will cause headache, difficult breathing, or loss of consciousness.

Move to fresh air.
If breathing has stopped, give artificial respiration.
If breathing is difficult, give oxygen.

LIQUID
Irritating to skin and eyes.
If swallowed, will cause nausea, vomiting, or loss of consciousness.

Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.
DO NOT INDUCE VOMITING.

Water Pollution

HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS.
Fouling to shoreline.
May be dangerous if it enters water intakes.

Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

Issue warning-high flammability
Evacuate area
Should be removed
Chemical and physical treatment

2. LABEL

2.1 Category: Flammable liquid
2.2 Class: 3

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Aromatic Hydrocarbon
3.2 Formula: m-$C_6H_4(CH_3)_2$
3.3 IMO/UN Designation: 3.2/1307
3.4 DOT ID No.: 1307
3.5 CAS Registry No.: 108-38-3

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Liquid
4.2 Color: Colorless
4.3 Odor: Like benzene; characteristic aromatic

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Approved canister or air-supplied mask; goggles or face shield; plastic gloves and boots.
5.2 Symptoms Following Exposure: Vapors cause headache and dizziness. Liquid irritates eyes and skin. If taken into lungs, causes severe coughing, distress, and rapidly developing pulmonary edema. If ingested, causes nausea, vomiting, cramps, headache, and coma; can be fatal. Kidney and liver damage can occur.
5.3 Treatment of Exposure: INHALATION: remove to fresh air; administer artificial respiration and oxygen if required; call a doctor. INGESTION: do NOT induce vomiting; call a doctor. EYES: flush with water for at least 15 min. SKIN: wipe off, wash with soap and water.
5.4 Threshold Limit Value: 100 ppm
5.5 Short Term Inhalation Limits: 300 ppm for 30 min.
5.6 Toxicity by Ingestion: Grade 3; LD_{50} = 50 to 500 g/kg
5.7 Late Toxicity: Kidney and liver damage.
5.8 Vapor (Gas) Irritant Characteristics: Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect is temporary.
5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin.
5.10 Odor Threshold: 0.05 ppm
5.11 IDLH Value: 10,000 ppm

6. FIRE HAZARDS

6.1 Flash Point: 84°F C.C.
6.2 Flammable Limits in Air: 1.1%-6.4%
6.3 Fire Extinguishing Agents: Foam, dry chemical, or carbon dioxide
6.4 Fire Extinguishing Agents Not to be Used: Water may be ineffective.
6.5 Special Hazards of Combustion Products: Not pertinent
6.6 Behavior in Fire: Vapor is heavier than air and may travel considerable distance to a source of ignition and flash back.
6.7 Ignition Temperature: 986°F
6.8 Electrical Hazard: Class I, Group D
6.9 Burning Rate: 5.8 mm/min.
6.10 Adiabatic Flame Temperature: Data not available
6.11 Stoichiometric Air to Fuel Ratio: Data not available
6.12 Flame Temperature: Data not available

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: No reaction
7.2 Reactivity with Common Materials: No reaction
7.3 Stability During Transport: Stable
7.4 Neutralizing Agents for Acids and Caustics: Not pertinent
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Molar Ratio (Reactant to Product): Data not available
7.8 Reactivity Group: 32

8. WATER POLLUTION

8.1 Aquatic Toxicity: 22 ppm/96 hr/bluegill/TL_m/fresh water
8.2 Waterfowl Toxicity: Data not available
8.3 Biological Oxygen Demand (BOD): 0 lb/lb, 5 days; 0% (theor.), 8 days
8.4 Food Chain Concentration Potential: Data not available

9. SHIPPING INFORMATION

9.1 Grades of Purity: Research: 99.99%; Pure: 99.9%; Technical: 99.2%
9.2 Storage Temperature: Ambient
9.3 Inert Atmosphere: No requirement
9.4 Venting: Open (flame arrester) or pressure-vacuum

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

A-T-U

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: Flammable liquid
11.2 NAS Hazard Rating for Bulk Water Transportation:

Category	Rating
Fire	3
Health	
Vapor Irritant	1
Liquid or Solid Irritant	1
Poisons	2
Water Pollution	
Human Toxicity	1
Aquatic Toxicity	3
Aesthetic Effect	2
Reactivity	
Other Chemicals	1
Water	0
Self Reaction	0

11.3 NFPA Hazard Classification:

Category	Classification
Health Hazard (Blue)	2
Flammability (Red)	3
Reactivity (Yellow)	0

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Liquid
12.2 Molecular Weight: 106.16
12.3 Boiling Point at 1 atm: 269.4°F = 131.9°C = 405.1°K
12.4 Freezing Point: —54.2°F = —47.9°C = 225.3°K
12.5 Critical Temperature: 650.8°F = 343.8°C = 617.0°K
12.6 Critical Pressure: 513.8 atm = 34.95 psia = 3.540 MN/m^2
12.7 Specific Gravity: 0.864 at 20°C (liquid)
12.8 Liquid Surface Tension: 28.8 dynes/cm = 0.0288 N/m at 20°C
12.9 Liquid Water Interfacial Tension: 36.4 dynes/cm = 0.0364 N/m at 30°C
12.10 Vapor (Gas) Specific Gravity: Not pertinent
12.11 Ratio of Specific Heats of Vapor (Gas): 1.071
12.12 Latent Heat of Vaporization: 147 Btu/lb = 81.9 cal/g = 3.43×10^4 J/kg
12.13 Heat of Combustion: —17,554 Btu/lb = —9752.4 cal/g = -408.31×10^4 J/kg
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: Not pertinent
12.16 Heat of Polymerization: Not pertinent
12.25 Heat of Fusion: 28.01 cal/g
12.26 Limiting Value: Data not available
12.27 Reid Vapor Pressure: 0.34 psia

NOTES

m-XYLENE

12.17 SATURATED LIQUID DENSITY

Temperature (degrees F)	Pounds per cubic foot
15	55.400
20	55.260
25	55.130
30	54.990
35	54.850
40	54.710
45	54.570
50	54.430
55	54.290
60	54.160
65	54.020
70	53.880
75	53.740
80	53.600
85	53.460
90	53.320
95	53.180
100	53.050

12.18 LIQUID HEAT CAPACITY

Temperature (degrees F)	British thermal unit per pound-F
40	.387
50	.393
60	.398
70	.404
80	.410
90	.415
100	.421
110	.426
120	.432
130	.437
140	.443
150	.448
160	.454
170	.460
180	.465
190	.471
200	.476
210	.482

12.19 LIQUID THERMAL CONDUCTIVITY

Temperature (degrees F)	British thermal unit-inch per hour-square foot-F
35	.962
40	.953
45	.944
50	.935
55	.926
60	.917
65	.908
70	.899
75	.890
80	.881
85	.873
90	.864
95	.855
100	.846

12.20 LIQUID VISCOSITY

Temperature (degrees F)	Centipoise
15	.938
20	.898
25	.862
30	.827
35	.794
40	.764
45	.735
50	.708
55	.682
60	.658
65	.635
70	.613
75	.592
80	.572
85	.554

12.21 SOLUBILITY IN WATER

Temperature (degrees F)	Pounds per 100 pounds of water
	I
	N
	S
	O
	L
	U
	B
	L
	E

12.22 SATURATED VAPOR PRESSURE

Temperature (degrees F)	Pounds per square inch
60	.090
70	.127
80	.177
90	.242
100	.326
110	.434
120	.571
130	.743
140	.956
150	1.219
160	1.538
170	1.924
180	2.388
190	2.939
200	3.590
210	4.355
220	5.247
230	6.282
240	7.476
250	8.846
260	10.410

12.23 SATURATED VAPOR DENSITY

Temperature (degrees F)	Pounds per cubic foot
60	.00172
70	.00238
80	.00324
90	.00435
100	.00577
110	.00754
120	.00975
130	.01247
140	.01577
150	.01977
160	.02455
170	.03023
180	.03691
190	.04473
200	.05382
210	.06431
220	.07635
230	.09009
240	.10570
250	.12330
260	.14310

12.24 IDEAL GAS HEAT CAPACITY

Temperature (degrees F)	British thermal unit per pound-F
0	.247
25	.260
50	.273
75	.286
100	.299
125	.311
150	.324
175	.336
200	.348
225	.360
250	.371
275	.383
300	.394
325	.406
350	.417
375	.427
400	.438
425	.449
450	.459
475	.469
500	.479
525	.489
550	.499
575	.508
600	.517

o-XYLENE

XLO

Common Synonyms	Watery liquid	Colorless	Sweet odor
1, 2-Dimethylbenzene Xylol	Floats on water. Flammable, irritating vapor is produced.		

Stop discharge if possible. Keep people away.
Call fire department.
Avoid contact with liquid and vapor.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

FLAMMABLE
Flashback along vapor trail may occur.
Vapor may explode if ignited in an enclosed area.
Wear self-contained breathing apparatus.
Extinguish with foam, dry chemical, or carbon dioxide.
Water may be ineffective on fire.
Cool exposed containers with water.

Exposure

CALL FOR MEDICAL AID

VAPOR
Irritating to eyes, nose and throat.
If inhaled, will cause headache, difficult breathing, or loss of consciousness.
Move to fresh air.
If breathing has stopped, give artificial respiration.
If breathing is difficult, give oxygen.

LIQUID
Irritating to skin and eyes.
If swallowed, will cause nausea, vomiting, or loss of consciousness.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.
DO NOT INDUCE VOMITING

Water Pollution

Dangerous to aquatic life in high concentrations.
Fouling to shoreline.
May be dangerous if it enters water intakes.
Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

Issue warning-high flammability
Evacuate area
Should be removed
Chemical and physical treatment

2. LABEL

2.1 **Category:** Flammable liquid
2.2 **Class:** 3

3. CHEMICAL DESIGNATIONS

3.1 **CG Compatibility Class:** Aromatic Hydrocarbon
3.2 **Formula:** $o\text{-}C_6H_4(CH_3)_2$
3.3 **IMO/UN Designation:** 3.2/1307
3.4 **DOT ID No.:** 1307
3.5 **CAS Registry No.:** 95-47-6

4. OBSERVABLE CHARACTERISTICS

4.1 **Physical State (as shipped):** Liquid
4.2 **Color:** Colorless
4.3 **Odor:** Benzene-like; characteristic aromatic

5. HEALTH HAZARDS

5.1 **Personal Protective Equipment:** Approved canister or air-supplied mask; goggles or face shield; plastic gloves and boots.
5.2 **Symptoms Following Exposure:** Vapors cause headache and dizziness. Liquid irritates eyes and skin. If taken into lungs, causes severe coughing, distress, and rapidly developing pulmonary edema. If ingested, causes nausea, vomiting, cramps, headache, and coma. Can be fatal. Kidney and liver damage can occur.
5.3 **Treatment of Exposure:** INHALATION: remove to fresh air; administer artificial respiration and oxygen if required; call a doctor. INGESTION: do NOT induce vomiting; call a doctor. EYES: flush with water for at least 15 min. SKIN: wipe off, wash with soap and water.
5.4 **Threshold Limit Value:** 100 ppm
5.5 **Short Term Inhalation Limits:** 300 ppm for 30 min.
5.6 **Toxicity by Ingestion:** Grade 3; LD_{50} = 50 to 500 mg/kg
5.7 **Late Toxicity:** Kidney and liver damage.
5.8 **Vapor (Gas) Irritant Characteristics:** *Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations.* The effect is temporary.
5.9 **Liquid or Solid Irritant Characteristics:** Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin.
5.10 **Odor Threshold:** 0.05 ppm
5.11 **IDLH Value:** 10,000 ppm

6. FIRE HAZARDS

6.1 **Flash Point:** 63°F C.C.; 75°F O.C.
6.2 **Flammable Limits in Air:** 1.1%-7.0%
6.3 **Fire Extinguishing Agents:** Foam, dry chemical, or carbon dioxide
6.4 **Fire Extinguishing Agents Not to be Used:** Water may be ineffective.
6.5 **Special Hazards of Combustion Products:** Not pertinent
6.6 **Behavior in Fire:** Vapor is heavier than air and may travel considerable distance to a source of ignition and flash back.
6.7 **Ignition Temperature:** 869°F
6.8 **Electrical Hazard:** Class I, Group D
6.9 **Burning Rate:** 5.8 mm/min.
6.10 **Adiabatic Flame Temperature:** Data not available
6.11 **Stoichiometric Air to Fuel Ratio:** Data not available
6.12 **Flame Temperature:** Data not available

7. CHEMICAL REACTIVITY

7.1 **Reactivity With Water:** No reaction
7.2 **Reactivity with Common Materials:** No reaction
7.3 **Stability During Transport:** Stable
7.4 **Neutralizing Agents for Acids and Caustics:** Not pertinent
7.5 **Polymerization:** Not pertinent
7.6 **Inhibitor of Polymerization:** Not pertinent
7.7 **Molar Ratio (Reactant to Product):** Data not available
7.8 **Reactivity Group:** 32

8. WATER POLLUTION

8.1 **Aquatic Toxicity:** >100 mg/l/96 hr/D. magna/TL_m/fresh water
8.2 **Waterfowl Toxicity:** Data not available
8.3 **Biological Oxygen Demand (BOD):** 0 lb/lb, 5 days; 2.5% (theor.), 8 days
8.4 **Food Chain Concentration Potential:** Data not available

9. SHIPPING INFORMATION

9.1 **Grades of Purity:** Research: 99.99%; Pure: 99.7%; Commercial: 95+%
9.2 **Storage Temperature:** Ambient
9.3 **Inert Atmosphere:** No reaction
9.4 **Venting:** Open (flame arrester) or pressure-vacuum

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

A-T-U

11. HAZARD CLASSIFICATIONS

11.1 **Code of Federal Regulations:** Flammable liquid
11.2 **NAS Hazard Rating for Bulk Water Transportation:**

Category	Rating
Fire	3
Health	
Vapor Irritant	1
Liquid or Solid Irritant	1
Poisons	2
Water Pollution	
Human Toxicity	1
Aquatic Toxicity	3
Aesthetic Effect	2
Reactivity	
Other Chemicals	1
Water	0
Self Reaction	0

11.3 **NFPA Hazard Classification:**

Category	Classification
Health Hazard (Blue)	2
Flammability (Red)	3
Reactivity (Yellow)	0

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 **Physical State at 15°C and 1 atm:** Liquid
12.2 **Molecular Weight:** 106.16
12.3 **Boiling Point at 1 atm:** 291.9°F = 144.4°C = 417.6°K
12.4 **Freezing Point:** −13.3°F = −25.2°C = 248.0°K
12.5 **Critical Temperature:** 674.8°F = 357.1°C = 630.3°K
12.6 **Critical Pressure:** 541.5 atm = 36.84 psia = 3.732 MN/m²
12.7 **Specific Gravity:** 0.880 at 20°C (liquid)
12.8 **Liquid Surface Tension:** 30.53 dynes/cm = 0.03053 N/m at 15.5°C
12.9 **Liquid Water Interfacial Tension:** 36.06 dynes/cm = 0.03606 N/m at 20°C
12.10 **Vapor (Gas) Specific Gravity:** Not pertinent
12.11 **Ratio of Specific Heats of Vapor (Gas):** 1.068
12.12 **Latent Heat of Vaporization:** 149 Btu/lb = 82.9 cal/g = 3.47 X 10^5 J/kg
12.13 **Heat of Combustion:** −17,558 Btu/lb = −9754.7 cal/g = −408.41 X 10^5 J/kg
12.14 **Heat of Decomposition:** Not pertinent
12.15 **Heat of Solution:** Not pertinent
12.16 **Heat of Polymerization:** Not pertinent
12.25 **Heat of Fusion:** 30.64 cal/g
12.26 **Limiting Value:** Data not available
12.27 **Reid Vapor Pressure:** 0.28 psia

NOTES

o-XYLENE

12.17 SATURATED LIQUID DENSITY

Temperature (degrees F)	Pounds per cubic foot
15	56.460
20	56.330
25	56.190
30	56.050
35	55.910
40	55.770
45	55.630
50	55.490
55	55.360
60	55.220
65	55.080
70	54.940
75	54.800
80	54.660
85	54.520
90	54.380
95	54.250
100	54.110

12.18 LIQUID HEAT CAPACITY

Temperature (degrees F)	British thermal unit per pound-F
35	.389
40	.391
45	.394
50	.396
55	.398
60	.400
65	.402
70	.404
75	.406
80	.408
85	.411
90	.413
95	.415
100	.417

12.19 LIQUID THERMAL CONDUCTIVITY

Temperature (degrees F)	British thermal unit-inch per hour-square foot-F
35	1.043
40	1.035
45	1.027
50	1.018
55	1.010
60	1.002
65	.993
70	.985
75	.977
80	.969
85	.960
90	.952
95	.944
100	.935

12.20 LIQUID VISCOSITY

Temperature (degrees F)	Centipoise
15	1.328
20	1.263
25	1.202
30	1.145
35	1.092
40	1.042
45	.995
50	.952
55	.911
60	.873
65	.836
70	.802
75	.770
80	.740
85	.712

12.21 SOLUBILITY IN WATER

Temperature (degrees F)	Pounds per 100 pounds of water
	I
	N
	S
	O
	L
	U
	B
	L
	E

12.22 SATURATED VAPOR PRESSURE

Temperature (degrees F)	Pounds per square inch
60	.071
70	.101
80	.141
90	.194
100	.263
110	.352
120	.465
130	.609
140	.787
150	1.007
160	1.277
170	1.605
180	1.999
190	2.469
200	3.028
210	3.686
220	4.456
230	5.352
240	6.389
250	7.581
260	8.947

12.23 SATURATED VAPOR DENSITY

Temperature (degrees F)	Pounds per cubic foot
60	.00135
70	.00188
80	.00258
90	.00349
100	.00464
110	.00611
120	.00794
130	.01021
140	.01298
150	.01634
160	.02038
170	.02520
180	.03090
190	.03759
200	.04539
210	.05443
220	.06484
230	.07674
240	.09030
250	.10560
260	.12290

12.24 IDEAL GAS HEAT CAPACITY

Temperature (degrees F)	British thermal unit per pound-F
0	.261
25	.274
50	.287
75	.299
100	.311
125	.323
150	.335
175	.347
200	.358
225	.370
250	.381
275	.392
300	.403
325	.414
350	.424
375	.435
400	.445
425	.455
450	.465
475	.475
500	.485
525	.494
550	.504
575	.513
600	.522

XLP

p-XYLENE

12.17 SATURATED LIQUID DENSITY

Temperature (degrees F)	Pounds per cubic foot
60	53.970
65	53.830
70	53.690
75	53.550
80	53.410
85	53.270
90	53.140
95	53.000
100	52.860
105	52.720
110	52.580
115	52.440
120	52.300

12.18 LIQUID HEAT CAPACITY

Temperature (degrees F)	British thermal unit per pound-F
60	.412
70	.418
80	.424
90	.429
100	.435
110	.440
120	.446
130	.451
140	.457
150	.462
160	.468
170	.474
180	.479
190	.485
200	.490
210	.496
220	.501
230	.507
240	.512
250	.518
260	.524
270	.529
280	.535

12.19 LIQUID THERMAL CONDUCTIVITY

Temperature (degrees F)	British thermal unit-inch per hour-square foot-F
60	.935
65	.928
70	.921
75	.914
80	.907
85	.900
90	.892
95	.885
100	.878

12.20 LIQUID VISCOSITY

Temperature (degrees F)	Centipoise
60	.678
65	.654
70	.631
75	.610
80	.590
85	.571
90	.552
95	.535
100	.519
105	.503
110	.488
115	.474
120	.460

12.21 SOLUBILITY IN WATER

Temperature (degrees F)	Pounds per 100 pounds of water
	I
	N
	S
	O
	L
	U
	B
	L
	E

12.22 SATURATED VAPOR PRESSURE

Temperature (degrees F)	Pounds per square inch
60	.096
70	.135
80	.187
90	.255
100	.343
110	.456
120	.599
130	.777
140	.998
150	1.270
160	1.600
170	1.998
180	2.475
190	3.041
200	3.710
210	4.493
220	5.407
230	6.465
240	7.683
250	9.080
260	10.670

12.23 SATURATED VAPOR DENSITY

Temperature (degrees F)	Pounds per cubic foot
60	.00183
70	.00252
80	.00343
90	.00459
100	.00607
110	.00792
120	.01022
130	.01303
140	.01646
150	.02059
160	.02553
170	.03138
180	.03826
190	.04629
200	.05561
210	.06636
220	.07867
230	.09270
240	.10860
250	.12650
260	.14670

12.24 IDEAL GAS HEAT CAPACITY

Temperature (degrees F)	British thermal unit per pound-F
0	.246
25	.259
50	.272
75	.285
100	.297
125	.309
150	.321
175	.333
200	.345
225	.357
250	.368
275	.380
300	.391
325	.402
350	.413
375	.424
400	.435
425	.445
450	.456
475	.466
500	.476
525	.486
550	.496
575	.505
600	.515

p-XYLENE

XLI

Common Synonyms	Watery liquid	Colorless	Sweet odor
1, 4-Dimethylbenzene Xylol	Floats on water. Flammable, irritating vapor is produced. Freezing point is 56°F.		

Stop discharge if possible. Keep people away.
Call fire department.
Avoid contact with liquid and vapor.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

FLAMMABLE
Flashback along vapor trail may occur.
Vapor may explode if ignited in an enclosed area.
Wear self-contained breathing apparatus.
Extinguish with foam, dry chemical, or carbon dioxide.
Water may be ineffective on fire.
Cool exposed containers with water.

Exposure

CALL FOR MEDICAL AID.

VAPOR
Irritating to eyes, nose and throat.
If inhaled, will cause dizziness, difficult breathing, or loss of consciousness.
Move to fresh air.
If breathing has stopped, give artificial respiration.
If breathing is difficult, give oxygen.

LIQUID
Irritating to skin and eyes.
If swallowed, will cause nausea, vomiting, loss of consciousness.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.
DO NOT INDUCE VOMITING.

Water Pollution

HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS.
Fouling to shoreline.
May be dangerous if it enters water intakes.
Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

Issue warning-high flammability
Evacuate area
Should be removed
Chemical and physical treatment

2. LABEL

2.1 **Category:** Flammable liquid
2.2 **Class:** 3

3. CHEMICAL DESIGNATIONS

3.1 **CG Compatibility Class:** Aromatic Hydrocarbon
3.2 **Formula:** p-$C_6H_4(CH_3)_2$
3.3 **IMO/UN Designation:** 3.2/1307
3.4 **DOT ID No.:** 1307
3.5 **CAS Registry No.:** 106-42-3

4. OBSERVABLE CHARACTERISTICS

4.1 **Physical State (as shipped):** Liquid
4.2 **Color:** Colorless
4.3 **Odor:** Like benzene; characteristic aromatic

5. HEALTH HAZARDS

5.1 **Personal Protective Equipment:** Approved canister or air-supplied mask; goggles or face shield; plastic gloves and boots.
5.2 **Symptoms Following Exposure:** Vapors cause headache and dizziness. Liquid irritates eyes and skin. If taken into lungs, causes severe coughing, distress, and rapidly developing pulmonary edema. If ingested, causes nausea, vomiting, cramps, headache, and coma. Can be fatal. Kidney and liver damage can occur.
5.3 **Treatment of Exposure:** INHALATION: remove to fresh air; administer artificial respiration and oxygen if required; call a doctor. INGESTION: do NOT induce vomiting; call a doctor. EYES: flush with water for at least 15 min. SKIN: wipe off, wash with soap and water.
5.4 **Threshold Limit Value:** 100 ppm
5.5 **Short Term Inhalation Limits:** 300 ppm for 30 min.
5.6 **Toxicity by Ingestion:** Grade 3; LD_{50} = 50 to 500 mg/kg
5.7 **Late Toxicity:** Kidney and liver damage.
5.8 **Vapor (Gas) Irritant Characteristics:** Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect is temporary.
5.9 **Liquid or Solid Irritant Characteristics:** Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin.
5.10 **Odor Threshold:** 0.05 ppm
5.11 **IDLH Value:** 10,000 ppm

6. FIRE HAZARDS

6.1 **Flash Point:** 81°F C.C.
6.2 **Flammable Limits in Air:** 1.1%-6.6%
6.3 **Fire Extinguishing Agents:** Foam, dry chemical, or carbon dioxide
6.4 **Fire Extinguishing Agents Not to be Used:** Water may be ineffective.
6.5 **Special Hazards of Combustion Products:** Not pertinent
6.6 **Behavior in Fire:** Vapor is heavier than air and may travel considerable distance to a source of ignition and flash back.
6.7 **Ignition Temperature:** 870°F
6.8 **Electrical Hazard:** Class I, Group D
6.9 **Burning Rate:** 5.8 mm/min.
6.10 **Adiabatic Flame Temperature:** Data not available
6.11 **Stoichiometric Air to Fuel Ratio:** Data not available
6.12 **Flame Temperature:** Data not available

7. CHEMICAL REACTIVITY

7.1 **Reactivity With Water:** No reaction
7.2 **Reactivity with Common Materials:** No reaction
7.3 **Stability During Transport:** Stable
7.4 **Neutralizing Agents for Acids and Caustics:** Not pertinent
7.5 **Polymerization:** Not pertinent
7.6 **Inhibitor of Polymerization:** Not pertinent
7.7 **Molar Ratio (Reactant to Product):** Data not available
7.8 **Reactivity Group:** 32

8. WATER POLLUTION

8.1 **Aquatic Toxicity:** 22 ppm/96 hr/bluegill/TL_m/fresh water
8.2 **Waterfowl Toxicity:** Data not available
8.3 **Biological Oxygen Demand (BOD):** 0 lb/lb in 5 days
8.4 **Food Chain Concentration Potential:** Data not available

9. SHIPPING INFORMATION

9.1 **Grades of Purity:** Research: 99.99%; Pure: 99.8%; Technical: 99.0%
9.2 **Storage Temperature:** Ambient
9.3 **Inert Atmosphere:** No requirement
9.4 **Venting:** Open (flame arrester) or pressure-vacuum

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

A-T-U

11. HAZARD CLASSIFICATIONS

11.1 **Code of Federal Regulations:** Flammable liquid
11.2 **NAS Hazard Rating for Bulk Water Transportation:**

Category	Rating
Fire	3
Health	
Vapor Irritant	1
Liquid or Solid Irritant	1
Poisons	2
Water Pollution	
Human Toxicity	1
Aquatic Toxicity	3
Aesthetic Effect	2
Reactivity	
Other Chemicals	1
Water	0
Self Reaction	0

11.3 **NFPA Hazard Classification:**

Category	Classification
Health Hazard (Blue)	2
Flammability (Red)	3
Reactivity (Yellow)	0

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 **Physical State at 15°C and 1 atm:** Liquid
12.2 **Molecular Weight:** 106.16
12.3 **Boiling Point at 1 atm:** 280.9°F = 138.3°C = 411.5°K
12.4 **Freezing Point:** 55.9°F = 13.3°C = 286.5°K
12.5 **Critical Temperature:** 649.4°F = 343.0°C = 616.2°K
12.6 **Critical Pressure:** 509.4 atm = 34.65 psia = 3.510 MN/m^2
12.7 **Specific Gravity:** 0.861 at 20°C (liquid)
12.8 **Liquid Surface Tension:** 28.3 dynes/cm = 0.0283 N/m at 20°
12.9 **Liquid Water Interfacial Tension:** 37.8 dynes/cm = 0.0378 N/m at 20°
12.10 **Vapor (Gas) Specific Gravity:** Not pertinent
12.11 **Ratio of Specific Heats of Vapor (Gas):** 1.071
12.12 **Latent Heat of Vaporization:** 150 Btu/lb = 81 cal/g = 3.4 X 10^5 J/kg
12.13 **Heat of Combustion:** —17,559 Btu/lb = —9754.7 cal/g = —408.41 X 10^5 J/
12.14 **Heat of Decomposition:** Not pertinent
12.15 **Heat of Solution:** Not pertinent
12.16 **Heat of Polymerization:** Not pertinent
12.25 **Heat of Fusion:** 37.83 cal/g
12.26 **Limiting Value:** Data not available
12.27 **Reid Vapor Pressure:** 0.34 psia

NOTES

Personnel onsite must always have access to communications. These communications may be to additional onsite personnel, in certain situations communications by team members to outside response agencies may be necessary.

ATTACHMENT "C"

SAFETY PROCEDURES/FIELD OPS (FLDOP'S)

2.4.2 Inclement Weather - FLD02

Health and Safety Plan Operating Procedures

Field Operating Procedure - FLD02 - Inclement Weather

Related SPOPSFLDS:

FLD05	Heat Stress Prevention and Monitoring
FLD06	Cold Stress
FLD25	Working at Elevations
FLD26	Ladders
FLD27	Scaffolds

2.4.2.1 Hazard

Hot weather (ambient temperatures over 70°F), cold weather (ambient temperature levels below 40°F), rain, snow, ice and lightning are examples of inclement weather that may be hazardous or add risk to WESTON work activities. Heat stress and cold stress are covered under separate Standard Procedures.

Extremes of heat, cold and humidity, as well as rain, snow and ice, can adversely affect monitoring instrument response and reliability, respiratory protection performance, and chemical protective clothing materials.

Heat

Additional examples and protection from heat stress are addressed in WESTON Safety Procedure FLD05. Hot dry weather increases risk of soil drying, erosion and dust dispersion which may present or increase risk of exposure and environmental impact from toxic hazards. Hot weather will increase pressure on closed containers and the rate of volatilization, thereby potentially increasing the risk of exposure to toxic, flammable, or explosive atmospheres.

Rain, Wet Weather, and High Humidity

Rain and wet conditions increase slipping and tripping hazards, braking distances of vehicles, and the potential for slippage or handling difficulties on other devices such as augers, drills, etc. Rain fills holes, obscures trip and fall hazards, and increases risk of electrical shock when working with electrical equipment. Rain changes soil conditions in trenching and excavating activities with the potential to form quicksand, weaken walls, and increase the

risk of cave-in. Vehicles become stuck in mud and tools and personnel can slip on wet surfaces.

Rain and wet conditions additionally decrease visibility (especially when wearing respiratory protection) and limit the effectiveness of certain direct-reading instruments e.g., PIDs.

Cold, Snow, and Ice

In addition to cold stress, which is covered in WESTON Safety Procedure FLD06, cold weather affects vehicle operation by causing window frosting and increased difficulty in starting and braking. Ice and snow can accumulate on windows and obscures vision.

Cold, wet weather cab cause icing of roadways, driveways, parking areas, general work places, ladders, stairs, and platforms. Ice is not always as obvious to see as is snow or rain and requires special attention especially as relates to driving speed and walking.

Snow and ice increases the risk of slipping when walking, climbing steps and ladders, working at elevation and of accidents when driving vehicles or operating heavy equipment. Heavy snow and ice storms may cause electric lines to sag or break, and use of electric equipment in snow increases the risk of electric shock. Snow can hide pot holes and mud, which can result in vehicles getting stuck or persons falling when stepping into hidden holes. Snow also may cover water, drums or containers, and sharp metal or sticks that can cause falls or punctures.

Personnel performing activities which require working over ice should be aware of minimal ice thickness safety guidelines as follows:

4 inch minimum: Activities such as walking or skating.
6 inch minimum: Activities such as snowmobiling or the use of equipment with the same weight and cross-sectional area as a snowmobile.

Personnel should always be aware that these measurements are under ideal conditions and that ice conditions on rivers, ponds or lakes with active currents, snow cover, and other environmental factors impact the safety of working on ice. Clear ice typically is the strongest while ice which appears cloudy or honeycombed is not as structurally sound. Measurements made by drilling or cutting through the ice should be made every few feet to verify safe conditions. Under no circumstances should WESTON personnel operate motor vehicles such as cars or trucks on ice.

Provisions for rescue, e.g., ladders or long poles and effective communications must be available.

Walkways, stairs, ladders, elevated workplaces, and scaffold platforms must be kept free of mud, ice, and snow.

Vehicles used in rain or cold weather must have windshield wipers and defrosters with windows kept clear of obstruction.

Employees must be protected from airborne contaminants using engineering controls such as wetting dry soil to prevent particle dispersion and providing local ventilation to reduce volatile air contaminants to safe levels, or if engineering controls are infeasible, using prescribed PPE.

Required conformance with traffic laws, including maintaining speed within limits safe for weather conditions, and wearing seat belts at all times.

Using a walking stick or probe to test footing ahead of persons walking where there is standing water, snow, or ice to protect the walker against stepping into pot holes or onto puncture hazards, buried containers, or other potential structurally unsound surfaces.

Prior to using vehicles or equipment in off-road work, walking the work area or intended travel way when puddles or snow may obscure pot holes, puncture hazards or buried containers, or other potential structurally unsound surfaces.

Arrange to have winches, come-alongs or other mechanical assistance available when vehicles are used in areas where there is increased risk of getting stuck. Cable or rope and mechanical equipment used for pulling stuck vehicles must be designed for the purpose, of sufficient capacity for the load, and be inspected regularly and before use to ensure safety. **Manually pushing stuck vehicles is to be avoided.**

Monitoring wind shifts and velocity where change may result in dispersion of airborne contaminants into work area.

Prior to working in areas or beginning projects during times when there is an increased likelihood of lightning or that increase the potential for lightning striking personnel, steps must be taken to predict the occurrence of lightning strikes, including:

a) Checking with client management to determine if there is any pattern or noted conditions that predict lightning or if there are structures that are prone to lightning strikes. Arrange for client notification when there is increased potential for lightning activities. Ensure that clients include WESTON workers in lightning contingency plans.

b) Monitoring weather reports.

c) Noting weather changes and conditions that produce lightning.

2.4.10 Manual Lifting and Handling of Heavy Objects - FLD10

Health and Safety Plan Operating Procedures

Field Operating Procedure - FLD10 - Manual Lifting and Handling of Heavy Objects

2.4.10.1 Hazard

Improper lifting can result in cuts, pinches, crushing and serious back, abdomen, arm and leg muscle, and joint injury.

Even "light" objects, lifted improperly, can contribute to injury causing cuts and muscle injuries.

Cuts, Pinching, and Crushing

Splinters, slivers, and sharp edges on objects to be lifted can result in cuts. Heavy objects can pinch or crush fingers, toes, arms, and legs between the object and nearby objects, i.e., walls, tables, counters, railings, and obstructions. Insects or other biological hazards on or under objects to be lifted can result in bites or scratches. Contamination of objects can lead to chemical or radioactive materials exposure.

Muscle and Joint Injuries

Muscle and joint injuries occur when objects to be lifted are too heavy or awkward, in restricted access areas, or are lifted improperly.

Lifting tasks, which are awkward and repetitive, involving even light objects can lead to nerve and joint damage.

2.4.10.2 Recognition and Hazard Assessment

The need for manual lifting must be identified as a physical hazard when project tasks specifically require manual handling or use of heavy equipment, and the following safe lifting techniques, must be instituted:

- Plan any lifting task, noting:
  - Contact hazards - Check each object before lifting for presence of splinters, slivers, sharp edges or parts, cracks and loose joints, signs of biological hazards, and chemical or radioactive material contamination.
  - Weight of object - Unless involved in weight training, recommended safe lifting weights for an average man or woman are 50 and 35 pounds respectively.

- Size and shape of object - Large and oddly shaped objects are more difficult to lift, even within safe weight limits, due to imbalanced center of gravity.
- Area in which lifting is to be done - Check for pinch points such as other objects close by and that there is room for safe lifting.
- Conditions under which lifting is to be accomplished - Check for wet or slippery surfaces. Also consider level of protection to be used and that Level B or A protection may add up to 40 lb to be lifted as well as restricting range of motion and adding to area restriction by increasing bulk.
- Route to be traveled if lifting involves carrying - Check walking and working surfaces for slip and trip hazards, note ramps, changes on level of elevation, and ladders or stairways that need to be negotiated.

2.4.10.3 **Prevention and Protection Programs**

- Identify the potential for contact hazards on objects to be lifted before lifting. Check each object before lifting, remove any noted hazards as feasible, wear gloves (at a minimum cotton), leather or kevlar, chemical resistant, etc., depending on the nature of the hazard. Also wear safety boots, coveralls and chemical protection as appropriate.
- Avoid contact with cracks or loose joints or cover if hands or body can come into contact to reduce hazards of pinching.
- Workers must know their lifting limitations, plan lifting, keep themselves reasonably in shape and get help if uncertain that they can lift safely, and, Managers must plan and allow for safe lifting. Safe lifting takes time.
- Lifting an object from the floor
  - Determine that object is within safe weight limit.
  - Check for contact hazards.
  - Check floor for slip hazards.
  - Check that there is ample space between the object to be lifted and

other objects to avoid pinching or crushing.

- Check that there is ample room to squat, lift, turn or maneuver without twisting the back or other muscles or joints.

- Walk the intended route of travel to identify, and remove slip and fall hazards, if possible.

- Identify changes in elevation, steps, ramps, stairs and ladders which must be negotiated.

- To lift objects which are square or rectangular in shape or form:

  - Place one foot slightly in front of the other.

  - Squat as close to the object as possible.

  - Grasp one of the top corners away from the body and the opposite bottom corner closest to the body.

  - Tilt the object slightly away from the body, tilt forward at the hips, keep the back straight and tuck in the chin.

  - Test to be sure the object is loose from floor and will lift without snagging.

  - Straighten the legs, keeping the back bone straight, pull the object into the body and stand up slowly and evenly without jerking or twisting.

  - If turning or change of direction is required, turn with feet without twisting the torso and step in the direction to travel

- To set an object down, reverse the sequence, being sure not to trap the bottom hand between the object & the surface on which the object is set.

This system, at first feels and seems awkward. Workers must be trained and have the opportunity to use the system with lighter objects before performing heavy lifting. For other shaped objects, the only modification needed should be hand hold position. When two or more persons are lifting, have a plan and a set of signals so lifting occurs simultaneously.

Do not carry objects in a manner which obstruct vision in line of travel and of feet and footing.

Carry objects so one hand is free for travel on stairs or there is unobstructed view of footing

and two hands are free for travel on ladders.

2.4.10.4 Manual Handling of Heavy Objects

Hazard

Manual maneuvering or handling of heavy objects without actually lifting is often required on hazardous materials, RCRA facilities, and construction sites. This often involves moving drums or other containers. Manual handling of heavy objects, even when not actually lifting, can pose all of the hazards of lifting including, cuts, pinches, bruises, crushing, muscle and joint strain, and hazardous material and biological hazard contact.

Recognition and Risk Assessment

The need for manual handling of heavy objects must be addressed in the planning stages of a project HASP. Drums and other containers which must be maneuvered, for access to information or sampling locations, that are inaccessible to mechanical handling equipment, require manual handling and special precautions. When handling of heavy objects does not actually involve lifting, workers can handle heavier objects, even those weighing several hundred pounds, safely if proper techniques are used. In many instances, the procedures involve balancing and taking advantage of the shape of the object.

Prevention and Protection Programs

Prior to performing manual handling, it must be determined that it can be done safely and that mechanical assistance is infeasible.

Mechanical equipment or assistance such as dollies, carts, come-alongs or rollers are to be used whenever possible. Mechanical assistance must be of proper size, have wheels sized for the terrain, and be designed to prevent pinching or undue stress on wrists. Objects to be moved must be secured to prevent falling and properly balanced to prevent tipping.

The minimum protection for manual handling is heavy cotton or leather gloves, safety boots, and coveralls. Metatarsal guards, chemical protective clothing, and metal mesh or kevlar gloves must be used as risk of heavy items falling, hazardous materials contact and sharp edges, splinters or slivers increases.

Workers must be aware of their handling capacities and work within their capacities.

Objects to be manually handled must be checked prior to beginning movement for contact hazards and ensure handling will not trap hands, arms, legs, or feet between the object and other objects, walls, or railings.

Properly trained personnel may roll round or cylindrical objects if rolling will not damage the structural integrity. Rolling must be controlled by chutes, tag-lines, or other means of limiting acceleration. Workers must not be positioned down hill from rolled objects. Use of the legs for pushing and tag-line control of rolled objects must be stressed.

Only properly trained, personnel may move cylindrical objects which must remain upright by hand. Cylindrical objects, such as drums that must remain upright, are handled manually by slightly tilting the object using the legs for control and balancing the object on the bottom edge. The handler then walks beside the object, with the object tilted toward the body, positioning the hands on the top edge away from the body and moving so they do not cross, thus, maintaining the balance and a steady controlled forward motion. Motion must be controlled so that stopping walking and moving the hands will stop forward motion.

Prior to moving cylindrical objects in this way, the route of travel must be walked to identify any changes of elevation, pot holes, or other obstructions that could cause the object to snag, tip, or get out of control.

Flat, square, or rectangular objects are most easily handled using make-shift rollers or skids to break the friction with the resting surface and pushing, using the legs.

2.4.11 Rough Terrain - FLD11

Health and Safety Plan Operating Procedures

Field Operating Procedure - FLD11 - Rough Terrain

Related SPOPSFLDs:

FLD02 Inclement Weather
FLD15 Remote Areas

2.4.11.1 Hazard

Physical hazards associated with rough terrain include vehicle accidents, falling, slipping and tripping. Driving vehicles on uneven surfaces creates a possibility of the vehicle rolling, getting stuck in mud or ditches, or of an accident due to flat tires or striking obstacles, and vehicles. Falling is a potential hazard when working near mountain cliffs or steep inclines. Steep surfaces covered with heavy vegetation and under growth create a tripping hazard. Heavy or downed vegetation can hide holes or breaks in the terrain which increase risk of falls or vehicle accidents. Contact with animals, poisonous plants or insects may be increased due to vegetation or uneven terrain.

2.4.11.2 Recognition and Risk Assessment—

Rough terrain complicates work activities and adds or increases risk. In the planning stages of a project, rough terrain must be considered as a physical hazard. Risk assessment is usually accomplished from site history information (i.e. site topography) and onsite by the Site Health and Safety Coordinator (SHSC).

2.4.11.3 Hazard Prevention and Protection Programs

Hazard prevention can be achieved by ensuring all maintenance is performed on vehicles before going to the field. In order to minimize accidents, a site surveillance on foot might be required to choose clear driving paths. The site crew should be alert and observe terrain while walking to minimize slips and falls. Boots that are ankle high or higher provide additional support and stability and should be worn. Seatbelts should be worn at all times. Fall protection is required when there is a potential for falls.

Personnel should maintain a high level of physical conditioning due to increased body stress/exertion. Personnel should be aware of potential hazards and ensure proper/adequate first aid supplies and knowledge of the nearest medical assistance.

2.4.12 Housekeeping - FLD12

Health and Safety Plan Operating Procedures

Field Operating Procedure - FLD12 - Housekeeping

Related SPOPSFLDS:

FLD29 Material Handling
FLD33 Demolition
FLD39 Illumination

2.4.12.1 Hazard

Hazards associated with poor housekeeping include; slips, trips, falls, punctures, cuts, and fires.

2.4.12.2 Recognition and Risk Assessment

Good housekeeping is an important element of accident prevention. Good housekeeping should be planned at the beginning of the job and carefully supervised and followed to the final clean-up.

In the planning stages of a project and safety plan, housekeeping requirements must be addressed. Risk assessment can be accomplished in the development stages of a project by listing in the HASP, good housekeeping requirements and the hazards associated with poor housekeeping (i.e., slips, trips and falls). The true determination of risk must often be made on-site by the Site Health and Safety Coordinator (SHSC). It is important that the SHSC be alert to poor housekeeping practices and assist in maintaining order when large quantities of equipment or materials are stored onsite.

2.4.12.3 Prevention and Protection Programs

Poor housekeeping can be prevented by establishing 3 steps:

1) Plan ahead. A materials storage area which has been planned is more orderly than one which has developed haphazardly.

2) Assign responsibilities. If the size of the job and working force merit, a person should be specifically detailed to clean-up. Ideally, each individual should pick up after themselves and keep the site neat.

3) Implement the program. Housekeeping must be part of the daily routine, with clean-up being a continuous procedure.

Poor housekeeping accidents can be prevented by adhering to the following:

Lunch areas should be kept clear of empty bottles, containers, and papers. Trash disposal cans should be provided. An effective means of preventing litter is the provision of suitable receptacles for hazardous waste as well as nonhazardous wastes.

Accumulation of flammable and combustible liquids on floors, walls, etc., is prohibited. All spills of flammable and combustible liquids must be cleaned up immediately. Combustible waste, such as soiled rags, paper, etc, are to be stored in a safe place such as a covered metal container and disposed of regularly.

WESTON Project Managers and WESTON Subcontractors should provide sufficient personnel and equipment to insure compliance with all housekeeping requirements.

Work will not be allowed in those areas that do not comply with the requirements of this section.

The SHSC and WESTON Subcontractors will inspect the work area daily for adequate housekeeping and record unsatisfactory findings on the daily inspection report.

If applicable, the decontamination line will be keep neat and free of debris.

Adequate lighting should be provided in or around all work areas, passageways, stairs, ladders, and other areas used by personnel.

All stairways, passageways, gangways, and accessways shall be kept free of materials, supplies, and obstructions at all times.

Loose or light material should not be stored or left on roofs or floors that are not closed in, unless it is safely secured.

Tools, materials, extension cords, hoses, or debris are to be used, disposed of or stored so as not to cause a tripping or other hazard.

Tools, materials, and equipment subject to displacement or falling should be adequately secured.

Empty bags having contained lime, cement, and other dust-producing material should be removed periodically as specified by the designated authority.

Protruding nails in scrap boards, planks, and timbers should be removed, hammered in, or bent over flush with the wood unless placed in containers or trucks for removal.

Walkways, runways, and sidewalks should be kept clear of excavated material or other obstructions and no sidewalls should be undermined unless shored to carry a minimum live load of one hundred and twenty-five (125) pounds per square foot.

Containers should be provided for storing or carrying rivets, bolts and drift pins, and secured against accidental displacement when aloft.

When rivet heads are knocked off, or backed out, they should be kept from falling.

Form and scrap lumber and debris should be cleared from work areas, passageways, and stairs in and around building storage yards and other structures.

All storage and construction sites should be kept free from the accumulation of combustible materials. All materials should be maintained in neat stockpiles for ease of access. Keep aisles and walkways clear of loose materials and tools.

Weeds and grass should be kept down. A standard procedure should be established for cleanup of the area as specified by the SHSC.

Rubbish, brush, long grass, or other combustible material must be kept from areas where flammable and combustible liquids are stored, handled, or processed.

2.4.14 Site Security - FLD14

Health and Safety Plan Operating Procedures

Field Operating Procedure - FLD14 - Site Security

Related SPOPSFLDS:

FLD15 Remote Areas
FLD39 Illumination

2.4.14.1 Hazard

When WESTON's responsibilities include site control, one area which is included is security, i.e., maintaining control of access to the site. Contingency plans are required to deal with unauthorized entry. Inquisitive and/or hostile persons may interfere with the monitoring/sampling effort, jeopardizing the safety of themselves as well as the safety of the field team.

2.4.14.2 Recognition and Risk Assessment

In the planning stages of a project and safety plan, the potential for security problems must be considered as physical hazards in the site specific Health and Safety Plan (HASP). Risk assessment can be accomplished in the development stages of a project by listing in the HASP, the most likely security problems which may be encountered. The true determination of risk must often be made onsite by the Site Health and Safety Coordinator (SHSC). It is important that the SHSC be alert to these hazards, does not take them simply as a matter of fact, and has time to notice them.

Entry to a site by unauthorized persons presents risks to the person(s) entering and to WESTON personnel who may have to interact with the individual(s). In many cases the unauthorized entry is accidental or unintentional, however, contingency plans must also include procedures for instances when unauthorized entry is deliberate or for purposes which could pose a threat to site personnel.

During the assessment of risk for each site, security problems must be identified. The contingency plan should identify ways to prevent and respond.

Security problems may arise from the site neighborhood due to:

- Socio-economic factors
- Client/neighbor
- Client/labor relations
- Poor lighting

- Remoteness and size of site
- Value of equipment and materials, etc
- Sampling equipment tampering

2.4.14.3 Prevention and Protection Program

Prevention programs are an integral portion of a Security Contingency Plan. An effective preventative measure is to inform all interested parties of the site activities. An attempt should be made to notify state and local police, the fire department, and any local/state governmental officials of the projects purpose and scope. This will allow those authorities to answer questions posed to them by local residents and the media by preparing statements on the projects purpose or by informing the public where to call for further information. This will alleviate the problem of work stoppage due to field personnel answering questions.

One must ensure that the client understands and approves of any information released. In most cases the liaison should be between the client and outside persons.

The Security Contingency Plan must:

- Identify the person responsible for implementing the Contingency Plan.
- State as the first priority the safety of WESTON personnel.
- Be designed to minimize the chance of confrontation and to obtain security assistance as quickly as possible.
- Assign the enforcement of security functions to properly trained and authorized or bonded agencies.
- Establish a communication procedure for obtaining assistance.
- Be communicated to site personnel.

Security Problem Prevention measures include:

- Community relations programs,
- Visible security precautions (i.e., fences, "keep out" signs)
- Carefully defined rules/requirements for authorizing site access,
- Clearly delineated access points and barriers around work areas,
- Vigilance by all site personnel,
- Adequate lighting,
- Working in pairs or teams in sensitive areas,
- Locking and storing equipment securely,
- Using discretion in discussions and conversations when off-site,
- Working to avoid confrontation.

In short, security prevention involves not advertising or inviting intrusion. The telephone number and instructions for obtaining security assistance must be clearly posted on-site.

2.4.18 OPERATION AND USE OF BOATS-FLD18

Health and Safety Plan Operating Procedures

Field Operating Procedure - FLD18 - Operation and Use of Boats

INTERIM RELEASE APPROVAL PENDING

Related SPOPSFLDS:

FLD02	Inclement Weather
FLD05	Heat Stress Prevention and Monitoring
FLD06	Cold Stress
FLD07	Wet Feet
FLD10	Manual Lifting of Heavy Objects
FLD15	Remote Areas
FLD19	Working Over or Near Water
FLD32	Fire Extinguisher Required and Requirements

2.4.18.1 Hazards

The hazards associated with the operation and use of boats include drowning, heat stress, cold stress, hypothermia, injuries from falling. The potential for back injuries due to improper lifting techniques also exists when working in boats.

Carelessness, horseplay, or other unsafe acts could cause injury to personnel when operating or using boats.

There are also hazards associated with untrained personnel operating boating equipment.

Lack of personal protective equipment or misuse of personal protective equipment could also result in injury or death.

2.4.18.2 General

Weston owned and/or operated vessels may only be manned and/or used by Weston personnel unless the operator of the vessel holds a current USCG Captains license and rating for the type of vessel being operated.

All occupants operating or using boats must wear a personal flotation device (PFD).

Craft used for transportation, safety boats or as work boats must be maintained in safe condition.

All craft, regardless of size, should be operated according to the applicable navigational

rules and regulations, and should be lighted in accordance therewith.

Running lights and deck lights, if required, should be checked daily.

All craft such as skiffs, jon boats, inflatable boats, row boats and power boats, used as safety boats, work boats or as personnel carriers, should have plainly marked in a clearly visible location the maximum number of persons that can be safety carried, and this number should never be exceeded.

Power boats - only personnel of proven experience in handling of power boats, who are familiar with rules of the road, should be assigned to operate power boats.

All boats should be equipped with life vests, preservers, boat hooks, line, lights, and oars for emergency use.

When a gasoline engine powered boat is not being operated, the fuel supply line should be disconnected or the fuel supply valve should be closed.

Smoking is prohibited during fueling operations.

2.4.18.3 Introduction, Recognition and Risk Assessment

Boats are used frequently in Weston field activities to gather environmental information and samples. The use of boats without adequate preparation and training can, however, lead to accidents and injuries.

Whether you are a passenger or whether you are in charge of a boat used for environmental monitoring, you have responsibilities for safety. You need some basic information about boat safety equipment and preparation and about routine boating procedures and emergency procedures. Even if you do not plan to pilot a boat, an accident may unexpectedly put you in command.

A Coast Guard study of boating accidents shows that the main cause of fatalities was boats capsizing due to someone standing up in the boat, improper loading of the boat, or ignoring weather warnings. Most boating fatalities resulted from boats capsizing. The second and third largest number of fatalities resulted from falls overboard and vessels sinking. Collisions were the second most frequent cause.

Every person operating a boat is legally responsible for equipping and operating the boat in compliance with Federal and State regulations and for any damage that may be caused by operation of the boat. The person in command of a boat is presumed to know the requirements for operation and navigation of the boat, the regulations that apply locally and the mandatory rules of the road.

The rules of the road are the codes governing the lights to be carried by boats, the signals

to be made and the action of one boat with respect to another when the risk of collision exists.

International Rules of the Road for preventing collision at sea were first formalized in 1889 for navigation in international waters. The United States has adopted similar rules that must be followed in all United States waters. (The U.S. is consolidating the separate rules that have existed for the Great Lakes, the Mississippi River and its tributaries, and the intracoastal waterway and other inland waters.)

This field operating procedure is intended as an overview of boating operation and safety, and it is much too brief to prepare you adequately to operate a boat. If you are going to operate a boat, for Weston or for your own pleasure, we recommend you take one of the courses offered by the Coast Guard Auxiliary on Boating Skills and Seamanship. Topics covered can include sailing, marine engines, navigation, ropes and knots, locks and dams, and safe boat handling and operation.

Much of the information in this field operating procedure has been drawn from publications of the U.S. Coast Guard Auxiliary and the U.S. Coast Guard. Many other references are available, such as "Chapman Piloting - Seamanship & Small Boat Handling" by Elbert S. Maloney. Please refer to these sources as well for further information.

Three major areas of boating safety will be discussed in this field operating procedure:
1.) The selection and preparation of the vessel and its equipment
2.) The preparation of information and other items needed for the field trip.
3.) The operation of the vessel under routine and emergency conditions.

2.4.18.4 Selection and Preparation of the Vessel

This section describes requirements for the selection and preparation of a vessel for compliance with Weston operating procedures, boating safety regulations, and recommendations for achieving more than the minimum protection required.

Only boats which are considered to be stable should be used for environmental monitoring and sampling projects. Canoes and kayaks, due to their tipable nature, are not considered to be stable and should not be used unless specific approval is obtained from Corporate Health and Safety.

One convenient way to see if a boat is in compliance with the minimum safety requirements is to request a complimentary inspection from the local Coast Guard Auxiliary. A member of the Coast Guard Auxiliary will examine the boat for compliance with the Federal regulations and additional recommendations which the Auxiliary considers desirable for safety. If the boat passes the inspection, a current Courtesy Examination decal will be placed on the boat. If the boat does not pass, a confidential report of deficiencies will be given to the boat owner.

Private boats are required to be numbered, usually with a number assigned by the State and occasionally by the U.S. Coast Guard.

Weight Carrying Capability

One of the most important safety requirements is limiting the weight of the total load on a boat to the rated capacity of the boat. Most boats built since 1972 have been required to display their load capacity on a plate mounted in the boat.

In the combination capacity plate and certificate of compliance for an outboard motorboat the first entry lists the manufacturer's rating of the maximum horsepower engine that is safe to use on the boat. The second entry lists the maximum number and weight of persons that can be carried and the third entry lists the maximum weight that can safely be carried by the boat (including persons, motor and gear). Some boats may have two plates: a certificate of compliance and a separate capacity plate.

In order to avoid exceeding the load carrying capacity of a boat, it is necessary to know the number and total weight of all passengers and the weight of all the equipment and gear planned to be taken on board, including fuel, food and environmental sampling apparatus. To this total weight must also be added the estimated weight of the water or other samples you plan to collect and bring on board.

The recommended maximum weight shown on the capacity plate may be more than can be carried safely under some weather condition and for some activities. For example, if rough water is expected, less weight should be carried so that the boat rides higher in the water and is less likely to be swamped by waves. It the planned sampling requires personnel to stand or lean over the side, the total weight carried should be adjusted to lessen the possibility that the boat may capsize.

Equipment Needed or Required

Equipment needed or required on all motorboats includes a fire extinguisher, a signaling device, means of preventing accumulation of flammable fuel vapors, flotation devices for personnel using the boat, visual distress signals, and lights if the vessel will be operated at any time before sunrise or after sunset.

Fire Extinguisher

Every motorboat needs to have a fire extinguisher suitable for putting out a fire in burning liquids or electrical equipment. Fire extinguishers must show approval by Underwriters' Laboratories, Inc. or another testing laboratory. For boats less than twenty-six feet in length the required extinguisher has to have a rating of B-1. This can be provided effectively by a 2½-pound dry chemical extinguisher (with a 1A:10B rating) or by a 2½-pound Halon extinguisher (with a 5B rating).

Small extinguishers usually have very limited fire fighting capability, and they may be inadequate for a fire involving liquid fuel. We recommend that new or replacement fire extinguishers be the dry chemical or Halon type with the largest capacity that will fit conveniently in the boat. (A 6-pound dry chemical fire extinguisher is on the market with a rating of 2A; 40B.)

If the Weston has responsibility for a fueling location, we recommend that a special extinguisher be installed there that is effective on spill fires, one that contains an aqueous-film-forming foam.

Signaling Devices for Navigation

Audible signals are required for communicating when meeting, crossing or passing other boats, and for signaling location in a fog or other weather conditions which obscure normal visibility. Signals are required by motorboats regardless of the length of the boat. However, the specific requirements for carrying a whistle, horn or bell are based on the length of boat.

Boats from 16 to 26 feet in length are required to carry a whistle or horn that can be heard for at least one mile. The device can be operated by mouth, hand or power. Longer boats have the same requirements except that the whistle or horn must be operated by power.

Preventing Accumulation of Fuel Vapors

Powered ventilation is needed for motorboats with enclosed spaces in which flammable fuel vapors may accumulate, such as engine and fuel tank compartments, in order to prevent explosion and fire. Special ventilation is not required in open boats in which flammable vapors are not likely to accumulate. (If gasoline is spilled in any boat, there will be an accumulation of flammable vapors in the boat until the vapors are removed by exhaust blowers or the wind.)

Personal Flotation Devices

All boats less than sixteen feet in length are required, by law, to carry at least one personal flotation device for each person aboard. Boats of greater length are required to carry at least one wearable personal flotation device for each person aboard plus one throwable flotation device.

There are five types of personal flotation devices that are approved by the Coast Guard. Four of the types are acceptable for recreational boats and readily available, Types I, II, III, and IV. A Type V work-jacket is not approved for recreational boats.

Of the four wearable types of approved flotation devices, only two types are designed to prevent the drowning of an unconscious person, Types I and II.

A Type I device is the familiar collar-type life jacket. It provides more than 20 pounds of buoyancy and is designed to deep the wearer afloat for extended periods of time in rough water. A Type I device is recommended for maximum protection. Type I devices are required on commercial vessels and on licensed passenger-carrying vessels. (Reflective tape is required on Type I devices on passenger-carrying vessels.)

A Type II device is more wearable than a Type I device, but it has less buoyancy (15.5 pounds) and is less able to turn an unconscious person face upwards.

A Type III personal flotation device is designed to keep a conscious person in a vertical or slightly backward position, but not to turn an unconscious person over from a face downward position (even though it does have some turning ability). Buoyancy provided is 15.5 pounds minimum.

A Type IV personal flotation device is not designed to be worn but to be thrown to a conscious person in the water. Buoyancy provided is 16.5 pounds. One type IV device is required for each boat sixteen feet and over in length. Type IV devices are permitted as the minimum required in canoes, kayaks, and other vessels less than sixteen feet in length.

A Type V personal flotation device is a wearable work jacket designed to deep a conscious person in a vertical or slightly backward position, but it is not designed to turn an unconscious person over from a face downward position. Buoyancy provided is 27 pounds minimum. (Type V devices are not approved for use in recreational boats, and they usually cannot be purchased in stores that sell only recreational boats and equipment.)

If you are going out on a boat for Weston, a type I or II Personal Flotation Device must be used. For cold weather operations, recommended devices are float coats or exposure suits, both Coast Guard approved, or wet suits.

Visual Distress Signals

Visual distress signals are needed for any boating activity where you may need to signal for emergency help. If you are close to another boat, you can wave your outstretched arms up and down to signal distress. However, as you get farther from shore or other boats, you need some other way to signal your need for help. By carrying approved visual distress signals, boaters can assure that they have a noticeable and effective way of attracting attention to secure prompt assistance in case of an emergency.

Since January 1981, visual distress signals have been required for all recreational boats except manually-propelled boats, boats less than 16 feet in length, open sailboats less than 26 feet in length, boats on Western rivers and boats participating in organized events such as races and regattas.

When a search is underway the time it takes to locate a boat in difficulty or a person in the water can be reduced by the use of visual distress signals.

There are two types of signaling devices: non-pyrotechnic and pyrotechnic. Each device is approved for day use, for night use or for both day and night. Visual distress signaling devices must carry the manufacturer's certification that they meet Coast Guard requirements.

Non-pyrotechnic devices include:

An orange distress flag, 3 feet square with a black square and a black ball. This is accepted as a day signal only.

An electric distress light which must automatically flash the international SOS distress signal (three short flashes, three long flashes, and three short) four to six times each minute. (An ordinary flashlight is not acceptable since it must be flashed manually and does not normally produce enough candle power.) This is accepted as a night signal only.

One flag and one electric distress light will meet the requirements for visual distress signals. These are best for small boats because there is less chance for fire and explosion than with pyrotechnic devices.

Pyrotechnic devices that meet the requirements include:

Hand-held orange smoke distress signals (Day use only)

Floating orange smoke distress signals lasting 5 or 15 min. (Day use)

Hand-held red flare distress signals (Day or night use)

The minimum number of pyrotechnic devices required (because they are single-use devices, with limited burning time) is three for day use and three for night use, or three which can be used effectively either day or night.

There are pistol-projected parachute red flare distress signals which require suitable approved launching devices. These signals can be used in the day or at night. Also approved for day or night use are self-contained rocket propelled parachute red flares and red aerial pyrotechnic flare signals which may need approved, suitable launching devices.

Visual distress signals are an important part of a boat's safety and survival gear. They should be in good condition and easily accessible. Pyrotechnic devices must be stored to protect them from water, puncturing and access by children. They must also be handled very carefully so that you do not set fire to the boat.

Pyrotechnic devices that have passed their expiration date (42 months from the date of manufacture) need to be replaced. Check the expiration date on your pyrotechnic devices if you have them.

(Later we will discuss when and how to use visual distress signals, and your obligations if you see them used by another boater.)

Identification Lights

Every boat is required to be equipped with certain lights if it is on the water at any time after sunset and before sunrise. The purpose of these lights is to identify the boat's location so that collision can be avoided.

Vessels underway after sunset and before sunrise are required to display at least three lights: a green light and a red light each visible for one mile, and a white light visible for two miles. (Details of location and visibility distance may vary depending on the area in which the boat will be operating.)

The green light must be visible only from directly ahead of a boat and on the right or starboard side of the boat through an arc of 112½ degrees, or only as far back as an angle of 22½ degrees to the rear of a right angle from the centerline of your boat.

In the corresponding sector on the left side of a vessel, from dead ahead to 2 points abaft the port beam, the vessel must display a red light.

Each vessel must also display a white light that can be seen from all directions. Two white lights are required for vessels operating in international waters, and two lights may be used by vessels in other waters. One white light must be visible through the combined arcs of the red and green lights and be mounted one meter (3.3 feet) higher than they are. The second white light must be visible from the rear of the boat, through the arc that is not covered by the front white light.

Under the rules governing all United States waters (except the Great Lakes until march, 1983), motorboats 26 feet through 65 feet in length must have an additional white light in the forepart of the vessel that is visible for a distance of two miles through the same arc of visibility as the red and green lights, 20 points.

The nautical jargon for the 112½ degree arc of visibility for your starboard green light is: "Visible from dead ahead to 2 points abaft the starboard beam". You have to know that in nautical terminology, a circle of 360 degrees has 32 points, corresponding to the points of the compass, and that each point equals 11,¼ degrees of the circle. Another way of describing the arc of visibility would be to say that on a boat heading North, the green light would have to be seen by boats approaching from any direction between North and East-South-East.

What is especially important about the particular arc of 112½ degrees, or 10 points, for the boat you are in, is that it represents the "Danger Zone", for the boat, the directions in which the boat must yield the right of way to other vessels. Any vessel that can see the green light on the boat can "Go", because it has the right of way.

In that sector of approach, you are in the Give Way vessel (or Burdened vessel). The other vessel is the Stand On vessel (or Privileged Vessel).

If you expect to be out in a boat after dark in waters where you may encounter large vessels, tugboats, or working boats, you will want to find out exactly what lighting they will display so that you can stay out of danger.

Additional Equipment Recommended

In addition to equipment that is needed or required, there is other equipment which is recommended for safe boating operations.

Some of the recommended equipment includes an up-to-date chart of the area in which you will be operating a boating, a compass for open waters, paddles or oars, a boat hook, and a bailing bucket or bilge pump.

The Coast Guard Auxiliary recommends that each boat carry a first aid kit, emergency water and food, an anchor and rope, a radio for monitoring weather information and a radiotelephone for emergencies.

The Coast Guard Auxiliary also recommends that spare parts and tools be carried in case of engine trouble or an emergency. They recommend that outboard motorboats carry spare spark plugs, starter cord, shear pins, cotter pins and a propeller. For inboard motorboats, they recommend a bilge pump, a carburetor drip pan, a backfire arrestor, spark plugs, coil, fuel pump, fuel filter element and gasket, points and condenser, propeller, distributor or parts, generator and starter brushes, fuses, V-belts and spare oil.

The anchor taken on a trip should be selected for the bottom where you may anchor and be capable of holding the boat against wind and current. Since anchors hold better against a horizontal pull, a three-foot length of chain is recommended to hold the top of the anchor down. You should also have seven times the length of anchor rope as the depth of water.

Recommended Inspections

Before a boat is taken out on a field trip, it should be inspected carefully to see that the engine has an adequate fuel supply and is in good working order, that all navigation and communication equipment is working, and that all safety equipment is on board and accessible.

The Coast Guard Auxiliary has information in their publications which can be used to develop a pre-trip checklist for each type of boat. They also provide information that could be used to prepare guidelines for engine troubleshooting and for routine engine maintenance.

Refueling Precautions

Gasoline is so flammable and boats are so susceptible to damage from fire that special safety precautions must be taken. Four basic precautions are: keep all sources of ignition away from flammable vapors, keep the nozzle of the fueling source in contact with the fill opening to prevent static sparks, avoid overfilling tanks and never fill portable fuel tanks in the boat. (Portable tanks should be filled on the dock or at another location.)

The precautions for fueling boats with inboard engines are usually more elaborate than for outboard motors, because inboard engine fuel tanks cannot be filled remote from the boat and special ventilation equipment is needed.

2.4.18.5 Preparation of Information and Other Items

After the boat and its equipment are ready, there are several other key steps in preparing for safe use of a boat.

Weather information and navigation aids should be acquired, a plan for the trip should be prepared and filed, passengers should prepare their personal gear and sampling apparatus and equipment must be weighed and loaded.

Weather Reports

Weather reports are particularly important for small craft, because such craft generally have less freeboard and seaworthiness than larger vessels.

If predicted weather conditions are likely to result in wind and waves, the load may have to be lightened or the trip may have to be shortened or postponed.

Navigation Charts

Up-to-date navigation charts and a compass should be taken and information should be obtained about any unusual navigation hazards that may be likely in the waters you will be in, such as shoals, sandbars, rocks, or rapids.

Float Plans

The Coast Guard recommends that boaters prepare a plan for each trip and file it with someone who can request a search if the need arises. The plan for a boat trip called a "Float Plan", should tell where you are going, when you will be back, who is on board and what your boat looks like.

The Coast Guard recommended format for a Float Plan (a copy of which is available with this unit) provides space for recording:

1.) Description of boat in detail, so the boat can be identified and its position can be estimated
2.) Persons aboard
3.) Radio type and frequencies available
4.) Trip expectations, and latest expected return time
5.) Name and telephone numbers of coast Guard or other agency to be notified if return is delayed beyond latest expected return time.

A Float Plan for an environmental sampling trip should be filed with the Weston office associated with the project or someone else who can judge when to request or provide assistance. (A Float Plan for a boat trip is similar in purpose to a flight plan for a plane trip.)

Personal Gear

Personal gear should include appropriate footwear, clothing to provide protection from extremes of heat and cold, extra dry clothing, medication for motion sickness, if needed, and a water-resistant outer garment to keep spray from wetting inner clothing. If water temperatures below 60°F or 16°C are expected, wearing a float coat, wet suit or exposure coveralls is recommended.

Sampling Apparatus and Equipment

Sampling apparatus and equipment should be weighed and the weight marked on an outside surface for convenience in balancing the load in a boat. It will also make it easier to calculate the total load being placed in a boat and to avoid overloading the boat. In figuring the load on the boat, remember to add the estimated weight of samples to be gathered on the trip.

Preparation for Emergencies

Preparation for emergencies should include making sure that everyone in the boat can put on his or her personal flotation device quickly and correctly, and that everyone knows to stay with the boat if it should capsize. Preparation should also be made for any other emergency procedures. (If the passengers on the boat include non-swimmers, they should wear personal flotation devices when there is any likelihood that they may fall into the water.)

One of the Coast Guard requirements for personal flotation devices that are not worn is that they be readily accessible. They must not be in a locker or obstructed by other gear.

Field personnel should plan how to conduct scheduled sampling activities with minimum disturbance of the balance of the boat or risk of capsizing or falling out of the boat. Planning should include any special precautions that may be needed (such as using a safety

line on a piece of apparatus or on a person using sampling equipment).

In order to prevent capsizing or swamping, a boat must not be overloaded. The total load of passengers, motor, sampling apparatus and other gear should not exceed the weight limit stated on the capacity plate on the boat. It may be prudent to reduce the load in the boat if inclement weather, turbulent water conditions, or vigorous sampling activities are anticipated.

Getting Into and Loading a Boat

Getting into and loading a boat at a dock takes a little care and practice, because it is different from simply stepping down to another level. If you board a boat the wrong way, it may move away from the dock or it may tip precariously. Be sure that the boat is secured to the dock, then grasp one or both sides of the boat and step into the center of the boat. By stepping into the center of the boat, or as near the centerline as possible, you minimize tipping and the chance that you may loose your balance.

Loading gear into a boat also takes care and practice. If you load the wrong way, the boat may tip and the gear may fall into the boat or the water.

With both feet on the dock, pass the gear to the person in the boat. Unless you have to load the boat yourself, work with another person.

In preparation for loading a small boat, arrange the equipment and other gear you plan to take on board near the edge of the dock where it can be reached easily.

One person should stand in the center of the boat and take the gear passed over and down by another person.

Sampling apparatus, equipment and containers must be loaded into a boat in a safe manner so there is no damage or spill. In the boat, the load should be stashed equally on both sides fore and aft (front and back) with the weight distributed as evenly as possible.

All sampling gear, particularly any that is heavy, should be tied down or secured to keep it from moving around when the boat gets underway, turns, vibrates, or reacts to rough water.

Although sampling activities may require standing up or leaning over the side of the boat, such actions should be done carefully and under controlled conditions, when the boat is not moving. When the boat is moving, everyone should sit on the seats provided. No one should ride on the bow or gunwales (sides) of the boat.

Personal flotation devices should be worn whenever there is a higher than normal risk of a person falling out of a boat, such as when the boat is moving at high speed or in rough water. (In some boating activities the safe practice would be to wear a personal flotation device at all times.)

2.4.18.6 Operation of the Vessel under Routine and Emergency Conditions

Boating Operations

Operation of a boat used for Weston field activities may be so routine that everyone knows how to operate the boat and is thoroughly qualified to operate it under all conditions. If that is not the case, we recommend that the person in charge of the boat familiarize a second person on board with the operation and navigation of the boat. By doing so there will be someone who can continue to run the boat and get it back to port if the pilot becomes disabled.

Weather Conditions

Before leaving the dock, be sure to check the local weather forecast for the area where you will be boating and look for weather signals which may be displayed at marinas, municipal piers, lighthouses or coast Guard stations.

The U.S. Weather Bureau publishes charts which give the locations and telephone numbers of all Weather Bureau offices and the location and time schedule of all stations that broadcast marine weather information. The charts also show the location of all storm warning display station. Charts for local areas can be obtained from the Government Printing Office.

A small craft warning indicates winds up to 38 miles per hour, or 33 knots, and /or sea conditions considered dangerous for small craft such as the ones used commonly in Weston activities. The daytime signal is one triangular red pennant. Although most display sites do not post night signals, the night signal for a small craft warning is one red light displayed above one white light.

A gale warning, with winds within the range of 34 to 47 knots, or 39 to 54 miles per hour, is signalled by two triangular red flags.

A storm, which may gave winds of 48 to 63 knots or 55 miles per hour up to 73 miles per hour, is forecast when a single square red flag with a black center is displayed.

Two square red flags with black centers are displayed only to show the forecast of hurricane or tropical cyclone, in which winds can be expected with speeds of more than 74 knots.

In addition to getting weather information before you leave on a boat trip, it is a good idea to keep track of the weather conditions as they develop while you are underway. You can do this by noting increases in wind speed or waves, changes in wind direction, or approach of storm clouds, listening for static on an AM radio, or monitoring a weather radio.

Rules of the Road

Every person operating a boat is legally responsible for any damage that may be caused by operation of the boat. For example, creating an unnecessarily large wake can cause problems in a crowded anchorage or other area, and the boat operator may be held responsible for any damage caused by such a wake.

The person in command of a boat is presumed to have knowledge of the requirements for operation and navigation of the boat, and of the regulations that apply locally, including the mandatory rules of the road.

The rules of the road that must be followed by everyone operating a boat govern three major subjects: identification lights, rules for steering and signaling course, and signals in fog. The major emphasis in this section will be on rules for steering and signaling course.

Rules for steering and for signaling course are designed to prevent collision by defining which of two approaching vessels has the right-of-way, and what signals are used to quickly signal intent and agreement or disagreement.

To use some nautical terms you may hear, the vessel which has the right-of-way is the privileged vessel, now referred to as the Stand On vessel. The Stand On vessel has a right to maintain its course and speed. It also has a duty to maintain its course and speed so that the other vessel can base its actions on known conditions. If a collision becomes imminent, the Stand On vessel no longer has the right-of-way or any privilege.

The vessel which does not have the right-of-way is the Give Way vessel, previously referred to as the "burdened" vessel. When this vessel approaches another closely enough so that collision is possible if both vessels continue, the Give Way vessel must slow or turn or take other positive action to keep out of the way.

The steering rules for power vessels apply when two are in sight of each other and close enough so that a collision could occur if both vessels continue on the same course at the same speed.

When two vessels are meeting, crossing or overtaking, which vessel has the right-of-way? What signals are used to communicate? Let's examine the three different situation, what actions have to be taken and what signals are used.

Meeting Situation

When two vessels are approaching head on or nearly so, in a meeting situation, neither has the right-of-way. If their courses are likely to result in a collision, both must alter their course to the starboard (right) so that each can pass safely to the port (left) of the other.

As a confirmation of its intention to take a particular course, a vessel will give a "course indicating signal" of one or two short blasts on a whistle or horn. In United States waters the other vessel will signal its understanding and agreement by answering with the same signal, and its lack of understanding or agreement by sounding the danger signal, four short blasts. (In international waters no response is required, and the danger signal is five short blasts.)

One blast in a meeting situation signals intention to alter course to the starboard and to pass the other vessel port to port. Two blasts in the same situation signals intention to alter course to the port and to pass starboard to starboard.

Crossing Situation

When two vessels are approaching at an angle in a crossing situation, the vessel on the right has the right-of-way. As we described earlier, your vessel must "give way' or yield the right-of-way to any vessel approaching from any direction on your right between dead ahead to two compass points abaft your starboard beam, the arc of 112½ degrees in which your vessel shows the green light at night. The Give Way vessel must slow or alter course to avoid collision, while the Stand On vessel maintains her course and speed. The U.S. signals are one short blast by the Stand On vessel to indicate intention to maintain course and speed, and an answering blast from the Give Way vessel to indicate that she has heard, understood the signal the signal and will keep clear. If there is any doubt, the danger signal of four blasts should be sounded and both vessels must stop. Then the vessels must exchange signals until there is an agreement on the courses to be taken.

If you see the red light of a vessel which is crossing your course at night, that vessel has the right-of-way and your vessel must keep clear.

Overtaking Situation

If one vessel is overtaking another, the overtaking vessel is burdened and must be ready to "give way" until the overtaken vessel has been passed safely.

If the overtaking vessel wishes to pass to the starboard side of the other vessel (altering course to the starboard), the overtaking (Give Way) vessel gives one short signal on the whistle or horn, and if she wishes to pass to the port side gives two short signals. The Stand On or privileged vessel (the one being overtaken) must either signal agreement by repeating the signal given or disagreement by giving the danger signal.

If you see the white light of another vessel at night, but cannot see either the red or green lights, you are approaching the vessel from the rear and you must follow the rules for overtaking another vessel.

Special Situation

If you are in a boat in a narrow channel, your boat must keep to the right side of the channel if possible, and when nearing a bend where another vessel might not be seen must signal with a prolonged whistle blast of 4 to 6 seconds. Your vessel must give the right-of-way to large deep-draft ships which may not be able to maneuver or stop easily.

Generally, right-of way must be given to fishing vessels, sailing vessels and very large vessels.

Fog Signals

In orders to avoid collisions in for or other condition of poor visibility, the rules of the road require all vessels to sound fog, mist, falling snow or heavy rain, by day or by night.

A power vessel underway must should one prolonged blast on the whistle at least every minute. A vessel at anchor (outside of a specified anchorage area) must ring its bell or sound its horn or whistle rapidly for five seconds at a time and at least one time each minute.

Towing vessels underway must sound a series of three blasts in succession every minute, with the series consisting of one prolonged and two short blasts.

Navigation Aids

On the navigable waters of the United States there is a system of aids to navigation that you should be familiar with: buoys, markers and lights.

The navigation aids are provided to mark channels and obstructions for the convenience and safety of vessels, to provide direction, and to give information on exact position.

The basic system provides black rectangular buoys or markers with odd numbers on one side of the channel, and red triangular buoys or markers with even numbers on the other side. On rivers, the black rectangular shapes and odd numbers will be on your left or port side if you are going up the flow of the river, returning from the sea.

When you are returning from the sea, going upstream, the red triangular shapes and the even numbers will be on your right or starboard side: "Red right returning". Conversely, if you find the red buoys on the opposite side, you are traveling downriver and heading toward the sea.

In the Great Lakes, going westerly or to the source of one of the lakes corresponds to going upstream from the sea. Going in that direction you will find the black rectangular and odd on your port side (left), and the red triangular and even on your starboard side.

On the Intracoastal Waterway, "upstream" or "returning from the sea" is marked from New

Jersey going south to the southernmost tip of Florida, and west to Texas. On the Pacific Coast, "upstream" is marked in the direction of travel from California to Alaska. Another way of viewing the system is that travel "clockwise" corresponds to "upstream".

Buoys and markers on the Intracoastal Waterway are marked with a yellow band, stripe, square or triangle. For example, a yellow band near the top of a black can buoy identifies it as being on the Intracoastal Waterway, as does a yellow square on a lighted black marker.

Regulatory markers may provide information or give warning, such as a boat speed restriction.

In waters too deep for other types of navigation aides, Texas Tower structures and lightships provide warning and guidance to ships. Most of the lightships have been replaced by the Texas Towers.

Large navigational buoys have primary and standby generators for operation of a high-intensity light, a radio beacon and a fog signal. These 40-foot diameter buoys are replacing lighthouses at major harbor entrances. (They have meteorological monitoring apparatus for air and water temperature, wind speed and direction and other data.)

Some buoys have an automated light, a fog horn and a marine radiobeacon.

Boat Handling

Even in calm water a boat does not handle like any land vehicle. It turns differently, and it starts and stops differently. If you will be operating a boat, you should take one of the Boating Skills courses offered by the Coast Guard Auxiliary and practice handling a boat under calm conditions.

Even if you have operated a boat, you may not have had training or experience in handling one under conditions where there is heavy traffic, narrow channels, swift current, or stormy weather. Before you get into difficult conditions, try to get training in how to handle the boat you plan to use.

For example, the Boating Skills and Seamanship textbook and courses cover topics such as towing a disabled boat, operating on a river and going through locks, special hazards of dams, and navigating safely through waves that could capsize your vessel.

Boating Emergencies

Let's consider boating emergencies and two aspects of distress signals: when to use them and what to do if you hear or see them.

If your boat capsizes, loses power in high winds or heavy seas, or collides with a fixed object or another boat, you will need emergency help. If such an event occurs or if a member of

the team has a major medical emergency, you should call for help by any means available to you: horn, whistle, radio, or visual distress signals.

If you have a radio, you should send a "Mayday" distress message on either VHF Channel 16 or 2182 kilohertz, following the recommended format. A Mayday message must include the following information:

1.) Boat and call letters
2.) Location
3.) The nature of distress
4.) The number of persons aboard and conditions of any injured
5.) Estimated seaworthiness of the boat
6.) Description of the boat in important details
7.) Anything else that may help rescuers find you.

If you are close enough to shore or other vessels for someone to see your boat, you can use the short-range distress signal or arm waving as well as an orange smoke signal. (Do not stand up unless the water is calm.)

If no other vessel or source of assistance is close by, hoist a distress flag if you have one (and it can be seen) or use an electric distress light (if it is dark).

If you have only pyrotechnic distress signals, prepare to use them when someone is in a position to see them. Generally you must wait until you see or hear another boat or aircraft, or are reasonably sure that someone shore is in position to see your signal take action. Be careful when using pyrotechnic devices not to set fire to the boat or anything in it.

If your boat capsizes, " STAY WITH THE BOAT" Get into it if possible. Water conducts heat away from the body rapidly, and if immersed in 50 degree water, survival time may be as little as three hours.

Conserving body heat is important to extend survival time. Some of the things that you can do to conserve body heat are to:

1.) Wear the warmest personal flotation device available
2.) DO NOT SWIM AWAY FROM THE BOAT
3.) Get up out of the water as far as possible

If you can't get out of the water, assume the fetal position, the Heat Escape Lessening Posture. If there are several persons, huddle with others, side by side in a circle. Do not swim for shore unless there is absolutely no chance of rescue. The boat is easier to spot.

A response to a distress signal should be made by anyone near enough to answer or assist.

If you hear or see a distress signal and you have a radio, notify the nearest Coast Guard station on VHF marine Channel 16, or someone else on CB Channel 9. If you are in a position to assist without being endangered, you should. (There is a "Good Samaritan" clause in the Federal Boat Safety Act of 1971 to protect from liability anyone who provides or arranges towage, medical treatment or other assistance as an ordinary, reasonably prudent person would under the same or similar circumstances.

2.4.18.7 Legal Requirements and Additional Information

Registration

All boats must be registered and their numbers and validation stickers displayed.

The certificate of registration must be on board at all time when the boat is being operated. Livery boats under 26 feet in length, hired for less than seven days need not carry the certificate, but must have copy of the lease or rental agreement on board, signed by the owner/representative and by the person renting the boat. The agreement must show the registration number and the period of time for which the boat is rented.

Equipment

All boats to be used on WESTON projects will be require to have the equipment indicated below.

Required Safety Equipment

Class A (less than 16 feet long)

- 1 Type I, II, Personal Flotation Device (PFD) per person.
- 1 Class B-1 fire extinguisher (if required by boat design).
- 1 Whistle.
- Bilge ventilation and engine flame arrester on inboard engines.
- Lights: 1 white 32-pt stern light which must be higher than any other part of the boat; 1 red and green 10-pt side light forward (20 pt combined).

Bailer

All small boats should be equipped with a manual bailer. This can be a scoop purchased or home-made from a household plastic jug. A large sponge is frequently convenient for getting that last little bit of water out of a small boat.

Distress Signals

An outboard boat should be equipped with a distress signalling package consisting of several daytime orange smoke signals, several nighttime red flares, and an orange flag. (Do not consider flares a substitute for the orange smoke signals which are much more effective for use in daylight.) Each boat should also carry an auditory signal as well. A horn or whistle will serve quite suitably.

Flashlight or Lantern

Every outboard craft should be equipped with a flashlight or electric lantern whether or not it is ever intended to use the boat after dark. The item should be waterproof and it is desirable that it float if accidentally dropped into the water. Extra batteries, stored in a waterproof container, will often prove valuable in an emergency. Batteries in the flashlight or lantern, and the spares, should be renewed at the start of each boating season regardless of their apparent condition.

Operational Equipment

A magnetic compass is an item of equipment that cannot be placed solely in either the safety or operational category; it fits both. Almost all outboards in their various applications can make good use of a compass. Select one of adequate size and quality, and install it properly.

As most outboards are relatively open craft, it is particularly important that the compass be kept shielded from the sun's direct rays. When not in use, place a cover over its top; this should be completely light-tight; colored plastic or cloth will not do an adequate job.

Charts

One or more charts should be carried covering the waters being used. Make a point of keeping track at all times of where you are on a body of water.

Handling

Before getting underway, have all weight evenly distributed so that the boat will trim properly - level from side to side and slightly down at the stern, never down at the bow. Passengers should be seated toward the centerline of the craft and not hanging over the sides; not too many forward or aft. If the load is concentrated near the bow or stern, the boat will plow or drag needlessly, reducing your safety margin and increasing your fuel consumption. Proper trim is essential to proper performance.

In boarding from a pier, step into the boat as near to the center as possible, keeping body

weight low. If you're boarding from a beach, come in over the bow. Keep lines tight or have someone steady the boat.

Never jump into a boat or step on the gunwale (edge of the hull). If you have a motor or other gear to take aboard, pile it on the pier so that you can easily reach it from the center of the boat. Better still, have someone hand it to you after you are aboard. It is the team leader's responsibility to determine that each boat, after loading, is within the maximum allowed load.

Trim your boat as well as possible before getting underway. In smaller craft, it is dangerous for passengers to attempt to change places or move about while the boat is in motion. If such movement becomes essential, slow or stop the boat first, remembering in rough weather to keep enough momentum to retain steerage control and to keep the craft headed into wind and waves. Have the person who must move keep low and near the boat's centerline.

Outboard craft are often operated at relatively high speeds and their stability becomes a matter of safety. Some hulls will run straight ahead quite steadily but have a tendency to heel excessively, or even "flip over", when turned sharply.

The faster a boat goes, the less keel it requires, and the more important it is to reduce speed to a safe value before starting a turn. Never turn more sharply than necessary. Normal operation seldom requires a sudden, sharp, high-speed turn.

Every outboard operator must carry one or more types of emergency signalling equipment. These must be in good condition and ready for immediate use. If no distress equipment is on board, an outboard boatman in need of help can always signal by slowly and repeatedly raising and lowering his arms outstretched to each side while he stands in his craft (or from a kneeling position if rough water conditions make standing hazardous).

Whenever boating in unfamiliar waters, take advantage of "local knowledge"; watch the operation of boats piloted by skippers who are at home in these waters, and don't hesitate to ask questions about possible hazards.

Many persons who have not handled a small boat have the misconception that one can be maneuvered and stopped as easily as an automobile. This is not the case, however, much can be done with a boat if one takes it slowly and easily. The new boat operator should practice leaving from and returning to piers, and other maneuvers, until he has developed both skill and confidence. Take it cautiously at first and gradually build up to the procedures of experienced operators.

Always slow down gradually rather than pulling the throttle back quickly. All boats have a stern wave that will catch up with and pass the craft if it comes to an abrupt stop. This can bring water into the boat, especially if it has a low-cut transom with no motor well.

All boating at night will be performed at reduced speeds.

Should you become disoriented, or unsure of your position, stop the boat until you can determine where you are.

Radio contact between crews should be more frequent; crew check-ins at set intervals will be mandatory.

Emergencies

To help the Coast Guard assist you, the following steps are recommended:

1. Let someone know your plans for the day including destination or time of your return, planned stops enroute, and similar details; provide a good description of the craft.

2. Never use "Mayday" on the radiotelephone unless there is a great danger and immediate assistance is required; don't use it for such a situation as running out of fuel.

Accidents

Various studies have shown the following to be the major causes of boating accidents:

1.) Overloading, overpowering, and improper trim.
2.) High speed turns, especially in rough water.
3.) Failure to keep a sharp lookout for obstructions.
4.) Going out in bad weather (or not starting for home soon enough when good weather turns bad.
5.) Standing in a moving boat.
6.) Having too much weight too high in the boat, as when someone sits on the deck of a small outboard.
7.) Leaks in the fuel system.
8.) Going too far offshore.

Each of these factors, and others not listed here, should be avoided. A carefully matched boat, motor, and propeller, operated in accordance with the law and with courtesy, will go a long way toward eliminating accidents and even distressing moments. Always remember that the possibility of troubles always remains; be prepared to act in an emergency.

As soon as someone falls overboard, maneuver the boat's stern away from him. Shift into neutral immediately (kill the motor if you do not have a gearshift) and throw a buoyant cushion or life jacket near the victim - try to get it close, but don't try to hit him with it. Make sure you are well clear of the person in the water before shifting into gear again.

Circle around quickly, selecting a course that will allow you to approach the person with the boat headed into the wind or waves. Approach him slowly, taking care to come alongside and not over him. Stop the motor before attempting to get the victim aboard.

When alongside, extend a paddle or boathook to him, or him one end of a line. With the motor stopped, lead him around to the stern, where the freeboard is the lowest, if there is enough space at the transom for him to get aboard without hurting himself on the motor. If this is not feasible, help the victim aboard over the side as far aft as possible. In either case, the use of a boarding ladder will be of help. To avoid a capsize while he is coming aboard, other passengers should shift their weight to the opposite side to maintain trim as much as possible. When helping a person aboard, hold him under the armpits and lift gently.

In Case of an Accident

If you are involved in a boating accident, you are required to stop and give whatever help you can give without seriously endangering your boat or passengers. You must also identify yourself and your boat to any person injured or to the owner of any property damaged.

If you see an accident without being a part of it, you may now render assistance with reasonable assurance of freedom from liability. The Federal Boat Safety Act of 1971 contains a "good samaritan" section which provides that any person who renders assistance at the scene of a vessel accident will not be liable for civil damages from such action if he acts as a reasonably prudent man would have acted under the same circumstances.

When giving first aid, take your time. Usually there is more damage done by the well-meaning amateur that was ever caused by the actual injury. Remember, there are only three instances when speed in giving first aid is required: (1) when the victim has stopped breathing; and has no pulse (2) when there is arterial bleeding ; and (3) when the victim has been subjected to other injuries that may be life threatening. The measures required in these instances are taught in standard first aid courses.

2.4.19 Working Over or Near Water-FLD19

Health and Safety Plan Operating Procedures

Field Operating Procedure - FLD19 - Working Over or Near Water

Related SPOPSFLDS:

FLD02	Inclement Weather
FLD05	Heat Stress Prevention and Monitoring
FLD06	Cold Stress
FLD18	Operation and Use of Boats
FLD22	Heavy Equipment Operation
FLD23	Crane/Lifting Equipment
FLD24	Aerial Lifts/Manlifts
FLD25	Working at Elevation

2.4.19.1 Hazard

Hazards associated with working around water include drowning, frostbite, hypothermia, and or injury from falling into the water.

Heat stress hazards may also be present.

Carelessness, horseplay, or other unsafe acts could cause injury to personnel working over or near water.

There are also hazards associated with untrained personnel operating equipment.

Lack of personal protective equipment or misuse of personal protective equipment could result in injury or death.

2.4.19.2 Recognition and Hazard Assessment

Proper precautions should be taken at all times when personnel are working over or near water. Whenever there is a body of water in close proximity to a work location the proper safety procedures should be implemented. Requirements for equipment or procedures will be based upon an evaluation of work tasks, drowning and injury potential.

New field team members should be thoroughly indoctrinated in safe work practices pertinent to the work to which they are assigned.

2.4.19.3 Prevention and Protection Program

When working over or near water where there is potential for drowning, engineering controls such as installation of guardrails and toeboards or other personal protection equipment such as safety line systems shall be used to prevent falling in. In addition, flotation devices must be worn and other lifesaving devices must be present. PFD's should be designed to float helpless persons face up.

Safety nets.

a. Safety nets shall be provided when workplaces are more than 25 feet above the ground or water surface, or other surfaces where the use of ladders, scaffolds, catch platforms, temporary floors, safety lines, or safety belts are impractical.

b. Where safety net protection is required, operations shall not be undertaken until the net is in place and has been tested.

c.

1.) Nets shall extend 8 feet beyond the edge of the work surface where employees are exposed and shall be installed as close under the work surface as practical but in no case more than 25 feet below such work surface. Nets shall be hung with sufficient clearance to prevent user's contact with the surfaces or structures below. Such clearances shall be determined by impact load testing.

2.) It is intended that only one level of nets be required for bridge construction.

d. The mesh size of nets shall not exceed 6 inches by 6 inches. All new nets shall meet accepted performance standards of 17,500 foot-pounds minimum impact resistance as determined and certified by the manufacturers, and shall bear a label of proof test. Edge ropes shall provide a minimum breaking strength of 5,000 pounds.

e. Forged steel safety hooks or shackles shall be used to fasten the net to its supports.

f. Connections between net panels shall develop the full strength of the net. Where work locations are such that a reaching pole is infeasible, ring buoys with at least 90 feet of line must be available within 200 feet. A lifesaving skiff should be readily available where large water bodies or worker clothing or equipment burdens would make a ring buoy ineffective.

First aid supplies should be aboard all lifesaving craft or readily accessible and arrangements for ambulance service should be made as location changes.

Personnel should be discouraged from jumping to or from any craft which is not secured, and from jumping between crafts when a gangplank should be used.

Fall protection should be provided when working over or near water where there is a potential for falling or slipping into the water.

In areas subject to tidal flow or rising water levels, the SHSC will monitor the water level to ensure that employees will not be trapped between a work area and the water level.

2.4.19.4 Standard Operating Procedures

Equipment and procedures will conform to USCG and/or OSHA requirements and applicable local regulations.

Personnel working over or near water shall be provided with U.S. Coast Guard-approved Personal Floatation Devices (PFDs) (life jackets or buoyant work vests). The jackets or vests shall be worn whenever there is potential drowning hazard. PFDs should be designed to float helpless persons face up.

Prior to and after each use, PFDs and life preservers shall be inspected for defects which would alter their strength or buoyancy (i.e., rips, tears, holes, etc.). All defective units shall be removed from site and replaced. At no times will defective units be used.

U.S. Coast Guard-approved life rings (rope attachment not required) and ring buoys (rope attachment required) should have at least 90 feet of 3/8-inch solid braid polypropylene rope or equal, attached. The life rings or ring buoys shall be readily available for emergency rescue operations. Distance between ring buoys shall not exceed 200 feet. One ring buoy or life ring shall be provided on each lifesaving skiff.

Lights conforming to 16 CFR 161.012 will be required whenever there is a potential need for life rings to be used after dark. Lights on life rings are required only in locations where adequate general lighting (i.e. Floodlights) is not provided.

At least one lifesaving skiff shall be immediately available at locations where employees are working over or adjacent to water. Personnel trained in launching and operating the skiff shall be readily available during working hours. Skiffs shall be kept afloat or ready for instant launching. Skiffs shall be minimally equipped as follows:

a. Four oars (two if the skiff is motor powered).

b. Oarlocks attached to gunwales or the oars.

c. One ball-pointed boat hook.

d. One ring buoy with 90 feet of 3/8 solid braid polypropylene rope or equivalent line attached.

e. PFDs equaling the skiff rating for the maximum number of personnel allowed on board.

f. First Aid Kit.

In locations where waters are rough or swift or where manually-operated boats are not practical, a power boat suitable for the waters shall be provided and equipped for lifesaving.

The maximum number of passengers and weight that can safely be transported shall be posted on all launches, motorboats, and skiffs. This number shall not be exceeded and in no case shall the number of passengers (including crew) exceed the number of PFDs aboard. Outboard motors and skiffs shall meet the minimum floatation requirements of the Coast Guard. A certification tag affixed to the hull is satisfactory evidence of compliance. An efficient whistle or signal device shall be provided on all powered vessels to give signals required by the Navigation Rules applicable to the waters on which the vessel is operated.

Any vessel, except those easily boarded from the water, shall provide at least one portable or permanent ladder of sufficient length to rescue a person overboard.

Fixed ladders over 20 feet high shall have attached safety climbing devices for the attachment of safety belts or shall be enclosed in a safety cage.

A person in the water shall be considered a person overboard and appropriate action taken.

All general safety precautions will be adhered to when working over or near water to prevent accidents caused from careless behavior or horseplay.

Only personnel who are trained in the operation of marine equipment (boats, barges etc.) will be allowed to operate the equipment.

Ramps for access of vehicles or personnel to or between barges shall be of adequate strength, provided with guard rails, well maintained and properly secured. In the case of personnel access, a safe walkway may be substituted for the ramp. All routes of access and passageways shall be kept free of ice, snow, grease, mud, and other obstructions. Nonslip surfaces shall be provided on all working decks, stair treads, ship ladders, platforms, catwalks, and walkways particularly on the weather side of all doorways opening on deck.

Guardrails, bulwarks, or taut cable guardlines shall be provided for deck openings, elevated surfaces, and similar locations where persons may fall or slip from them. they shall be at least 42 inches high and have an intermediate rail.

If a Jacob's ladder is used it will be of the double rung or flat tread type. It will be well maintained and properly secured. The ladder will either hang without slack from its lashings or be pulled up entirely.

When the upper end of the access-way rests on or is flush with the top of the bulwark (side of the ship above the upper deck), steps properly secured and equipped with at least one hand rail approximately 33 inches in height shall be provided between the top of the bulwark and the deck.

Obstructions will not be laid on or across gangways. The access-way will be adequately illuminated for its full length. All attempts will be made to place the access-way in a position that the load will not pass over personnel.

Any obstruction in a passageway that restricts normal passage shall be posted with warning signs or distinctively marked. Employees shall not be permitted to pass fore and aft, over or around the deck loads unless there is a safe passage. Decks and other working surfaces will be maintained in a safe condition and adequate safe walkways will be maintained for passage around the deck. All deck fittings and other obstructions which present stumbling hazards shall be painted yellow or marked with yellow trim.

Personnel will not walk along the sides of covered barges with coamings (raised frame to keep out water) more than 5 feet high unless there is a 3-foot clear walkway, or a grab rail, or a taut handline.

Unless railings or other suitable protection exists, all personnel will use suitable protection against falling and/or drowning.

Floating Cranes

Barge mounted cranes, designed and constructed as a unit, shall be rated by the manufacturer.

All barge mounted cranes shall be on barges of sufficient size to limit list under load to approximately 5 degrees. The rated load of the crane shall not exceed the original capacity specified by the manufacturer.

Work shall be halted when significant wave action exists.

A load-radius chart and boom angle or radius indicator shall be provided within the operator's view. When load ratings are reduced to stay within the barge list limits, a new load rating chart shall be provided.

Floating cranes and floating derricks in use shall meet the requirements for design, construction, testing, installation, maintenance, and operation discussed in ANSI B30.8, Safety Code for Floating Cranes and Floating Derricks. Draglines shall meet power Crane and Shovel Association standard #1. Performance test shall demonstrate the strength stability, capability, and adequacy of power brakes clutches and controls in accordance with the following table:

PERFORMANCE TEST FOR FLOATING CRANES

Safe Working Load	Test Load
Up to 20 Tons	125% of working load
20 to 50 tons	Working load plus 5 tons
Over 50 tons	110% of working load

Truck and crawler cranes shall be securely attached to the barge. When stability of the barge is not a factor and control barriers are provided limited travel may be authorized by the designated authority.

The rated load of a barge mounted mobile crane shall not exceed the original capacity specified by the manufacturer.

2.4.20 Traffic - FLD20

Health and Safety Plan Operating Procedures

Field Operating Procedure - FLD20 - Traffic

Related SPOPFLDS:

FLD01 Noise Protection
FLD02 Inclement Weather

2.4.20.1 Hazard

Traffic presents hazards in two ways 1) when site workers are working close to roadways, the potential exists to be hit by oncoming traffic and 2) driving to, from and on the site pose an accident hazard.

2.4.20.2 Recognition and Risk Assessment

In the planning stages of a project and safety plan, the potential for traffic hazards must be considered as physical hazards in the site specific Health and Safety Plan (HASP). Risk assessment can be accomplished in the development stages of a project by listing in the HASP, the most likely traffic hazards which may occur. The true determination of risk must often be made on-site by the Site Health and Safety Coordinator (SHSC). It is important that the SHSC be alert to these hazards, does not take them simply as a matter of fact, and has time to notice them.

2.4.20.3 Prevention and Protection Program

Roadway Workers

Roadway workers should be aware of their location in reference to roadways and avoid working close to traffic.

Workers near roadways must wear reflective vests.

The following guidance should be used in planning work that will be adjacent to or within roadways. In all cases the local police department or transportation department must be consulted in order to comply with applicable requirements.

When open highway conditions prevail on approach to the work site, advance warning signs should be placed approximately 1500 feet in advance of the condition to which they are calling attention. Where a series of advance warning signs are used, the warning signs nearest the work site should be placed approximately 500 feet from the point of restriction

with additional signs at 500-1000 foot intervals. On expressway and limited access facilities, the advance warning distance should be increased to one-half mile or more. On city streets where more restrictive conditions generally prevail on the approach to the work area. Signs in the immediate vicinity of the work may be placed at closer spacings.

Flag persons may be required to control the speed of nearby traffic. Lights should be provided to mark flag person stations and barricading at night. Barricading is extended to the point where it is visible to approaching traffic.

Signs on fixed supports are usually mounted on a single post, although those wider than 36 inches or larger than 10 square feet in area should generally be mounted on two posts. Signs mounted on portable supports are suitable for temporary conditions.

Drivers

All drivers will be licensed regardless of whether they are operating on or off public highways. A government drivers license is required for WESTON employees and WESTON subcontractors if a government vehicle will be used.

If drivers are operating across state lines they should be familiar with laws governing traffic in states in which they will operate. All traffic rules and regulations, and all traffic control signs and devices should be followed. All operators are required to stay within posted speed limits at all times.

Drivers are required to make a daily inspection of their vehicles. The check should include steering, brakes, mirrors, lights, horn, tires, and windshield wipers. Any special safety items, such as back-up alarms, should also be checked to insure safe operation. Drivers should be required to report all defects, and repairs should be made promptly.
Drivers should make a visual check around a vehicle to assure clearance of objects and personnel before moving the vehicle.

Drivers should become familiar with all controls before operating an unfamiliar vehicle.

Drivers should operate vehicles defensively, and exercise special care when driving an unfamiliar roads, at night, and in inclement weather.

Drivers should give pedestrians the right of way.

Off-highway operation may require extra precautions to prevent shifting of load when crossing rough terrain.

Trucks should be backed under the direction of a signal person if the operator cannot view the area to the rear clearly.

Windshields, rear-view mirrors, and lights should be kept clean.

Based upon the size of the vehicle, or if specific quantities of hazardous materials are transported, the driver may be required to hold a Commercial Drivers License. If in doubt consult with the Shipping Department or Corporate Health and Safety.

Transporting Personnel

The SHSC will ensure that seat belts are installed and functional on all vehicles used by Weston personnel and Weston subcontractors, and that all passengers use them. The use of seat belts by all personnel is mandatory.

Some convenient means of mounting and dismounting the truck should be provided.

Personnel should be required to ride within the space provided, never on running boards, fenders, bumpers, or atop cabs.

Adequate wind protection should be provided for long distance trips, and during cold weather.

Personnel are not allowed to ride on the outside or back (such as in pickup trucks) of vehicles.

Transporting Materials

Materials loaded should be within the safe weight limit for the truck, and should not project beyond the truck body.
While being loaded, trucks should be properly blocked.

Trucks operated on public highways should conform to weight and clearance limitations of bridges, powerlines, overhead structures, and other restrictions.

No person should be permitted to remain in or on a truck being loaded by excavating equipment or cranes unless the cab is adequately protected against impact.

Pedestrian Protection Program

Pedestrians on-site should use discretion when crossing the streets or working near traffic. Pedestrians should use sidewalks whenever possible and not step from curbs unless vehicles are at a safe distance.

Vehicle Maintenance

Operators should immediately report any damage or failure of parts and accessories to the

SHSC. It is advantageous to have road flares, fire extinguishers, and other safety equipment on the vehicle at all times.
Vehicles should not be fueled from open cans or by other makeshift methods, as there is great danger of flash fire from hot engines.

Engines should be shut off while fueling.

2.4.32 Fire Extinguishers Required and Requirements - FLD32

Health and Safety Plan Operating Procedures

Field Operating Procedure - FLD32 - Fire Extinguishers Required and Requirements

Related SPOPSFLDs:

- FLD09 - Hot Work (Permits)
- FLD21 - Explosives
- FLD22 - Heavy Equipment Operation
- FLD30 - Hazardous Materials Use and Storage
- FLD31 - Fire Prevention/Protection/Response Plans
- FLD36 - Welding/Cutting/Burning

Fire extinguishers appropriate in size and classification shall be present, readily accessible, and ready for use in all areas where there is potential for fires.

Fire extinguishers must be used in conjunction with an emergency response or contingency plan.

Health and Safety Plans must identify number, type, and location of all fire extinguishers related to a specific project.

Health and Safety Plan Operating Procedures

Field Operating Procedure - FLD43

BIOLOGICAL HAZARDS

Certain biological hazards that response personnel may encounter include endemic hazards such as animals, insects, molds and fungus and plants. In addition, hazardous waste site personnel may be exposed to etiological agents (Infectious Diseases).

1.0 Endemic Biological Hazards

Identifying and understanding local flora and fauna is an important part of health and safety planning and protection. Animals, insects, molds and fungus and poisonous plants vary from site to site as does their likelihood of causing harm. Knowing how hazardous, where and what types of plants, animals, insects or molds and fungus are part of risk assessment and protection protocol determinations.

1.1 Animals

Animals represent hazards due to their poisons or venoms, size and aggressiveness, diseases transmitted or insects they may carry.

Poisonous snakes are common across the United States with the major variables being the type likelihood of encounter and the snake likely to be encountered. Moving containers, reaching into holes or just walking through high grass, swampy ares or rocks are activities which may result in encounters with snakes.

Being alert, using care in reaching into or moving containers and familiarization with habits and habitats of snakes in the vicinity of an incident or site are key factors in working safely.

A bite of any snake should be considered need for medical attention once proper first aid procedures have been followed.

Landfills and abandoned buildings often attract stray or abandoned dogs which become pack oriented and very aggressive posing serious risk of harm to unprotected workers.

Workers entering abandoned buildings should be alert and attempt to avoid cornering these animals which may provoke confrontation. Watching for dens, good housekeeping, and use of repellents are avoidance and protection protocols.

Animal borne diseases include rabies (mainly dogs, skunks, raccoons, bats and foxes). Again the incidence of rabies varies from area to area as do the animals most likely to be rabid

QUESTIONS AND ANSWERS ABOUT RABIES

Q. What is Rabies and how is it transmitted?

A. **Rabies is a viral infection most often transmitted by bites of animals infected with the virus.**

Q. What animals are most likely to be infected?

A. **Skunks, raccoons, foxes and bats are wild animals most frequently found to be infected with rabies, however, any warm blooded animal could be infected squirrels, groundhogs, horses, cattle and rabbits have been tested positive for Rabies. Dogs and cats are frequently rabies infected if not immunized.**

Q. How can you tell if an animal is Rabies infected?

A. **Rabies infection is not always apparent, but, signs to look for in wild animals are over aggressiveness or passivity. Spotting animals which are normally nocturnal (active at night) during the day and being able to approach them would be an example of unusual behavior. Finding a bat alive and on the ground is abnormal. The best precaution, however, is to observe wild animals from a safe distance, even if they are injured and avoid dogs and cats that you do not know.**

Q. What should you do if bitten by an animal you suspect is infected with rabies?

A. **As quickly as possible wash the bite area with soap, water and disinfect with 70% alcohol, then seek medical attention for follow-up.**

Try to capture the animal without being bitten again or contacting the mouth or any saliva or keep the animal under surveillance and call police for assistance in capturing he animal.

Have the animal tested. A dead animal believed to be infected should be preserved and tested. Health Departments are often sources of testing or information on where testing can be done.

Q. Is there a cure for Rabies?

A. **Rabies is preventable, even after being bitten, if treatment is begun soon enough. Hence, getting prompt medical attention and confirming that an animal which has bitten you is or is not infected are very important.**

Rabies is not curable once symptoms or signs of Rabies appear.

There are vaccines available which should be considered if a work assignment involved trapping animals likely to carry rabies. Medical Consultants must be involved in decisions to immunize workers against rabies.

Last Revision: 8/17/94

HANTAVIRUS ALERT

WESTON employees or contractors/subcontractors conducting field work in areas where there is evidence of a rodent population which in particular would include the deer mouse, should be aware of an increase level of concern regarding the transmission of "Hantavirus" associated diseases. The Hantavirus is believed to be associated with rodents, especially the deer mouse (*Peromyscus maniculanis)* as a primary reservoir host, and has resulted in approximately a dozen deaths in the southwestern U.S. in recent months. The Center for Disease Control and Prevention (CDC) is concerned that the virus may be distributed over a larger geographic area than originally suspected.

The Hantavirus can be shed by infected rodents in saliva, urine and feces. Human infection may occur when infected wastes are inhaled as aerosols produced directly from the animals or as dried materials introduced into broken skin or onto mucous membranes. Known infections of humans occur mostly in adults and are associated with activities that provide contact with infected rodents in rural/semirural areas.

Illness caused by the Hantavirus begins with one or more flu-like symptoms (i.e., fever, muscle aches, headache and/or cough), and progresses rapidly to severe lung disease. Early diagnosis and treatment are vital.

Personnel involved in work in areas where rodents and the presence of the Hantavirus is know or suspected will need to take personal protective measures and develop an expanded site safety plan. Field personnel involved in trapping or who could come in contact with rodents or their waste products wear respirators with HEPA filters, eye protection, Tyvek coveralls, chemical resistant gloves and disposable boot covers. Strict decontamination requirements are needed. Double bag collected mice, label and require specific handling, packaging, shipping, storage and analytical procedures to minimize the risks of exposure. More detailed procedures can be obtained from Corporate Health & Safety.

For employees and facilities in rural/semirural areas, the following risk reduction strategies would be appropriate.

- Eliminate rodents and reduce availability of food sources and nesting sites used by rodents.
- Store trash/garbage in rodent-proof metal or thick plastic containers with tight lids.
- Cut tall grass/underbrush in close proximity to buildings.
- Prevent rodents from entering buildings (e.g., use steel wool, screen, etc. to eliminate openings).

4. Symptoms

Early Signs (may very from person to person)

- Expanding skin rash
- Flu-like symptoms during summer or early fall, including:
  - chills, fever, headache,swollen lymph nodes
  - stiff neck, aching joints and muscles
  - fatigue

Later Signs

- Problems with the nervous system
- Heart problems
- Arthritis, especially in knees

5. Upon Onset of Symptoms:

- Notify your RSO and your supervisor
- Call Health and Safety or medical consultant for instructions:
- Follow instructions
- Submit incident report form.

One of the more dangerous and acute effects of insect bites or stings and most common cause of fatalities from bites - particularly bees, wasps, and spiders - is a sensitivity reaction. Anaphylactic shock due to stings can lead to severe reactions in the circulatory, respiratory, and central nervous systems, which can also result in death.

Site personnel must be questioned as to allergic reaction to insect bites. Anyone knowingly allergic should be asked if they carry a response kit and first aid providers must be instructed how to use the kit. The kit must be inspected to ensure it is in date.

Persons reporting stings must be given first aid and observed for signs of reaction such as unusual swelling, nausea, dizziness, shock. At the first sign of these symptoms, take the individual to medial facility for attention.

Fire ants are small red ants found primarily in southern and western states. There is some indication that in addition to being very painful, some persons may show allergic reaction.

It is important to note that animals may serve as hosts of insects which may spread diseases.

Ticks carrying Lyme Disease and Rocky Mountain Spotted fever are found on grass, but may be carried on animal. Bubonic Plague which has emerged in parts of Colorado, New Mexico and Arizona is apparently associated with fleas found on Prairie Dogs.

1.2 Insects

Insect spread diseases include **Rocky Mountain Spotted Fever** or **Lyme Disease** (tick), **Bubonic Plague** (fleas), malaria, and equine encephalitis (mosquito).

Lyme Disease is the second most rapidly spreading disease in the United States.

LYME DISEASE

1. <u>Facts</u>

- Definition:
  - Bacterial Infection transmitted by the bite of a deer tick
  - Prevalence (nationwide and other countries)
- Three stages/sizes of deer ticks:
  - • Larvae • Nymph ● Adult
- Tick season is May through October.
- Not all ticks transmit Lyme Disease.
- Ticks must be attached for several hours before Lyme Disease can be transmitted.
- Being bitten by a tick does not mean you will get Lyme Disease.

2. <u>Prevention and Protection</u>

- Wear light colored, tightly knit clothing.
- Wear long pants and long sleeved shirts.
- Tuck pant legs into shoes or boots.
- Wear a hat.
- Use insect repellant containing DEET (follow manufacturers instructions for use).
- Check yourself daily for ticks after being in grassy, woody areas.
- Request information from Health and Safety Medical Section on Lyme Disease.

3. <u>If Bitten:</u>

- Remove the tick immediately with a pair of fine-tipped tweezers. Grasp the tick as close to the skin as possible. Pull gently but firmly, without twisting or crushing the tick.
- Wash your hands and dab the bite site with an antiseptic.
- Save the tick in a jar with alcohol labeled with the date, the area where you picked up the tick, and the spot on your body where you were bitten.
- Monitor the bite for any signs of infection or rash.

Other insect hazards would include, mosquitos and scorpions.

There have been articles recently indicating increases in encephalitis in Florida. Encephalitis is reportedly spread by mosquitos. The local health department should be contacted.

1.3 Molds and Fungus

In addition to the previously discussed animal inhabitants of old buildings which are often part of hazardous materials sites, birds often invade the buildings, leaving behind debris and droppings often containing molds and fungus in dry form. Inhalation of this easily airborne dust can result in serious lung diseases such as histoplasmosis.

From the San Joaquin valley in California through the southern parts of California into Arizona and New Mexico there is a fungus which grows in the soil. When inhaled, this organism can produce a disease called "Fever", "Valley Fever" or technically Coccidiomycosis. Growing up in infected areas apparently provides a degree of resistance which newcomers to the areas do not have.

Awareness of the hazard and prudent use of respiratory protection are key factors in protection.

1.4 Plants

Toxic effects from plants are generally due to ingestion of nuts, fruits, or leaves. Of more concern to response personnel are certain plants including poison ivy, poison oak, and poison sumac, which produce adverse effects from direct contact. The usual effect is dermatitis - inflammation of the skin. The protective clothing and decontamination procedures used for chemicals also reduce the exposure risk from the plant toxins. Cleaning the skin thoroughly with soap and water after contact will reduce risk.

These organisms could potentially be present in viable states on hazardous waste site with Hepatitis Virus being the more likely to survive in temperatures outside of body temperature ranges.

The other potential for exposure would be to workers who could be infected. The OSHA Standard specifically includes first aid providers and is enforceable on site subject to the Hazardous Waste Site Work and Emergency Response Standard (29 CFR 1910.120) which occasions the need for this course and course manual.

The basic concept of this standard is that medical care workers and first aiders must take the **"Universal Precaution"** of assuming that any blood containing fluid or person bleeding or contaminated with blood containing fluid is **positive (infected) with both viruses.**

Protection involves use of personal protection such as gloves, gowns, eye shields, surgical masks, one-way valve rescue breather devices, training and disinfectant decontamination.

Bloodborne pathogens are pathogenic microorganisms which may be present in human blood and can cause disease in humans. These pathogens include, but are not limited to hepatitis B virus (HBV) and human immunodeficiency virus (HIV).

In order to effectively protect themselves from any hazards, workers must have a basic understanding of the hazard. This is particularly true of Site Supervisors and SHSC's and others expected to administer first aid if necessary.

Completion of safety plans requires identification of and assessment of risk of exposure to biological hazards. This program deals primarily with two forms of infection (Hepatitis B Virus (HBV) and Human Immunodeficiency Virus (HIV)) which are of concern to workers who can come in contact with bodily fluids associated with blood.

If Medical waste is anticipated on a site, WESTON's Employee Exposure Control Plan for Hazardous Waste workers will be implemented. At a minimum WESTON's Bloodborne Pathogen Exposure Control Plan for first aid providers will be on site and implemented for each project.

HEPATITIS B VIRUS

Definition - The term "hepatitis" simply means an inflammation of the liver. This condition can be caused by a wide variety of agents, including medications, alcohol, toxic or poisonous substances and infectious agents such as viruses. Hepatitis B, formerly known as "serum" hepatitis, is the only form of viral hepatitis that poses a significant occupational threat in the health care environment.

Symptoms - HBV is a disease that causes liver damage, the severity of which can range from mild or even inapparent to severe or fatal. Of the infected individuals, 6 - 10% will become HBV carriers. Carriers are at risk of developing chronic liver disease, including active hepatitis, cirrhosis, and primary liver cancer, and are infectious to others (USHHS and NIOSH, 1989).

Incidence - Nationwide, there are approximately 300,000 new cases of hepatitis B infection each year and about 5,000 deaths due to this disease. In health care employees alone, there are approximately 12,000 cases of occupational hepatitis B infection each year and more than 200 deaths.

Approximately 5 percent of the entire U.S. population, more than 12 million people, have been infected with hepatitis B in the past. Of great concern from a transmission point of view is the fact that nearly one half of all such cases will be subclinical.

Many individuals become carriers of this disease without knowing that they have ever been infected. The carrier rate is approximately 10 percent. It is estimated that, in the United States alone, there are approximately 750,000 to 1,000,000 asymptomatic carriers of the virus. As patients, these individuals pose as a substantial reservoir of hepatitis B infection in the health care environment.

Sources of Infection - The hepatitis B virus has been isolated from various body fluids including blood, semen, vaginal secretions, breast milk, saliva, and serous fluid. Within the health care setting, however, hepatitis B is thought to be transmitted primarily by percutaneous or permucosal exposure to contaminated blood. Such exposure usually consists of inoculation of contaminated blood through such means as needle sticks or the splashing of blood or blood tinged body fluids into the eyes or mouth.

Risk - There is a direct relationship between the likelihood of occupational hepatitis B infection and the frequency of blood contact. Health care professionals such as surgeons, operating room-staff, pathologists and emergency room personnel exhibit a very high incidence of exposure to this virus. It is the frequency of blood contact which determines the level of risk.

PROTECTIVE MEASURES

Protective measures against hepatitis B infection include good handwashing practices and using caution and proper technique in the handing of needles, sharps, supplies and instruments that may be contaminated. Excellent protective treatment for or prevention of this disease is afforded by both hepatitis B immune globulin (HBIG) and by hepatitis B vaccine. Either or both of these should be given as soon as possible after any documented exposure to blood (Johnson and Johnson, 1992).

AIDS is not hereditary, but it can be congenital. In fact, vertical transmission which involves passage of the virus from an infected woman to her unborn child, is the third major means of transmission and accounts for the majority of cases of pediatric AIDS.

Risk - There is a common misconception that health care workers are at high risk for acquiring HIV infection through occupational exposure. In truth, studies confirm the fact that this supposed risk is far less than one percent. Of the thousands of health care workers in the United States and other parts of the world who have been exposed to HIV through patient contact, very few have developed subsequent infection.

PROTECTIVE MEASURES

AIDS is a concern of immense proportion to the health care community. However, from an occupational health point of view, there is little reason for undue concern regarding this virus. Simple employment of good personal hygiene, common sense and the barrier techniques which are discussed in this plan will serve well to prevent health care workers from contracting HIV infection or any other serious illness in the workplace (Johnson and Johnson, 1992).

HUMAN IMMUNODEFICIENCY VIRUS

Definition - Human Immunodeficiency Syndrome or AIDS is a severe viral disease only recently introduced into the Untied States. AIDS severely affects the immune system and is characterized by a multitude of opportunistic infections.

The AIDS virus (HIV or human immunodeficiency virus) is typical of most viruses in that it cannot survive for any appreciable amount of time outside of its human host. Its presence in the general environment is extremely unlikely and would be limited to body secretions, primarily blood and semen. Being an unstable virus, HIV is very susceptible to a large number of common household disinfectants.

Symptoms - The outcome or manifestation of illness varies with individuals who are infected with the virus.

Some infected persons have no disease symptoms and may not show outward signs of the disease for many years.

Some infected persons suffer less severe symptoms than do those with diagnosed cases of AIDS. These lesser symptoms may include loss of appetite, weight loss, fever, night sweats, skin rashes, diarrhea, tiredness, lack of resistance to infection, and swollen lymph nodes.

AIDS is the result of the progressive destruction of a persons immune system, which is the body's defense against disease. This destruction allows diseases that the body can normally fight to threaten the person's health and life. A particularly dangerous type of pneumonia and certain other infections often invade a body weakened by HIV. HIV can also attack the nervous system and cause damage to the brain. This may take years to develop. The symptoms may include memory loss, indifference, loss of coordination, partial paralysis, or mental disorder (USHHS and NIOSH, 1989).

Incidence - Over the past decade, approximately 210,000 cases of AIDS have been reported in the United States. In addition, there are an estimated one million individuals who have been infected with the virus but have not yet developed the disease. It is important to remember that these individuals are generally without symptoms yet they are carriers of the virus and thus potentially infectious.

Sources of Infection - The various modes by which HIV can be transmitted are well defined. Male homosexual and bisexual practices along with intravenous (IV) drug abuse are certainly two major means of transmission.

Although not as efficient a mode of spread, heterosexual transmission does occur, and is increasing in incidence in several countries around the world. Comparatively fewer individuals have contracted AIDS as the result of receiving contaminated blood or blood products. In addition, the advent of laboratory tests to detect infection with HIV has all but eliminated any possibility of this mode of transmission.

ROY F. WESTON INC. - BLOODBORNE PATHOGENS

EXPOSURE CONTROL PLAN - FIRST AID PROVIDERS

1.0 Scope and Application

Bloodborne pathogens are pathogenic microorganisms which may be present in human blood and can cause disease in humans. These pathogens include, but are not limited to hepatitis B virus (HBV) and human immunodeficiency virus (HIV). OSHA requires compliance with 29 CFR 1910.1030, Occupational Exposure to Bloodborne Pathogens Standard, where as a condition of employment, there is known or potential exposure to bloodborne pathogens. A source of occupational exposure may occur when an employee gives First Aid and CPR to an individual who has infectious blood. The occupational exposure occurs when potentially infectious materials come in contact with the employees eyes, mucous membranes, non-intact skin through cuts and abrasions while administering First Aid and CPR. Additional sources of exposure are contact with infectious waste found at hazardous waste sites, glassware, needles other sharp objects which have been involved in injuries to personnel resulting in contamination with blood or related bodily fluids and laboratory personnel who may analyze samples containing infectious waste.

This Exposure Control Plan addresses protection of First Aid Providers. An additional Plan deals with exposure to Bloodborne Pathogens through contact with Infectious Waste.

WESTON sites distant from medical facilities, require employees to be trained to render First Aid to comply with 29 CFR 1910.151 (b) as well as 29 CFR 1910.120 which requires provision of first aid services at hazardous waste sites. WESTON Site Health & Safety Coordinators (SHSCs) and Site Supervisors are required to be certified in First Aid and CPR.

WESTON personnel are engaged in delivery of First Aid and CPR in the pre-hospital setting. First Aid and CPR duties are often performed in uncontrolled environments, which, due to a lack of time and other factors, do not allow for application of a complex decision-making process to the emergency at hand.

This document serves as WESTON's Exposure Control Plan for First Aid Providers and is intended to assist personnel in making decisions concerning the use of personal protective equipment (PPE) and resuscitation equipment, as well as for decontamination, labeling, containerizing and disposal procedures.

3.2 Designated First Aid Providers

Site Supervisors and SHSC's and those required to be certified in First Aid and CPR and may be at risk from Bloodborne Pathogens if these services are rendered.

Attachment 2 lists the First Aid and CPR sub-tasks which may be required for SHSC's.

4.0 Methods of Compliance

4.1 Universal Precautions

When treating a victim for an injury, conducting CPR or handling potentially infectious waste, the universal precautions are an approach to infection control. According to the concept of universal precautions, all human blood and certain human body fluids are treated as if known to be infectious for HIV, HBV and other bloodborne pathogens. Body substances, including feces, urine, or vomitus are not included, unless they contain visible blood. Under circumstances in which differentiation between body fluid types is difficult or impossible, all body fluids shall be considered potentially infectious materials.

4.2 Work Practices

Work practice controls reduce the likelihood of exposure by altering the manner in which a task is performed.

- While wearing gloves, avoid touching personal items, such as a comb. Also avoid touching your face and eyes, etc.
- Mouth suctioning of blood or other infectious materials is prohibited.
- When handling sharps such as needles used for bee stings or diabetes, do not recap, purposely bend, break by hand, remove from disposable syringes, or otherwise manipulate by hand. As soon a possible after use, contaminated sharps are to be placed in puncture proof/leak proof containers until they can be disposed of. Broken glassware which may be contaminated shall not be picked up directly with the hands unless gloves to protect the hands against cuts are used. It is best to use mechanical means, such as a brush and dust pan then place contaminated broken glass in a puncture proof/leak proof container.

The training program for Bloodborne Pathogen Exposure awareness and control is described above. Site health and Safety coordinators as well as Region and Division Safety Officers and Corporate Health an Safety all have audit responsibility which incindes monitoring for conformance with the Occupational Exposure to Bloodborne Pathogens Standard.

5.0 Personal Protective Equipment (PPE)

PPE is specialized clothing or equipment worn by an employee for protection against a hazard. Attachment 3 provides examples of recommendations for PPE in the pre-hospital setting; the list is not intended to be all-inclusive. WESTON's Regional Safety Officer (RSO) will ensure that first aid kits (office and field kits) are supplied with the PPE listed in Attachment 3 and are checked on a monthly basis and restocked when used. Items identified in Attachment 3 should be purchased through Equipment stores. The items identified by asterisk in Attachment 3 will become a standard part of every WESTON first aid kit.

If the chance of being exposed to blood is high, the care giver should put on protective attire before beginning CPR or First Aid. Protective barriers should be used in accordance with the level of exposure encountered.

Minor lacerations or small amounts of blood do not merit the same extent of barrier used as required for massive arterial bleeding. Management of the patient who is not bleeding and who has no bloody body fluids present, should not routinely require use of barrier precautions.

Under rare or extra-ordinary circumstances, a responding employee may decide, based on his or her judgement, that use of PPE would have prevented delivery of care or would have posed an increased hazard to safety of the employee or co-worker. When this judgement has been made, an investigation of the event will be initiated and documented in order to determine what changes in procedures or protective equipment is needed.

General work clothes (e.g.,coveralls, pants shirts or blouses) not intended to function as protection against a hazard are not considered to be PPE.

The following PPE may be required for the tasks described in Section 3.1.

All PPE should be inspected prior to use. Defective PPE will not be used.

All PPE will be removed prior to leaving a contaminated area and secured properly for decontamination or proper disposal.

6.0 Decontamination

Decontamination uses physical or chemical means to remove, inactivate, or destroy bloodborne pathogens on a surface or item to the point where they are no longer capable of transmitting infectious particles and the surface or item is rendered safe for handling, use or disposal. All spills of blood and blood-contaminated fluids should be promptly cleaned up. At a minimum, if volume of fluids is large, gown, booties, eye protection, hair protection and disposable respirators should be worn. If a large area is contaminated with potentially infectious blood, bodily fluids etc. then this area should be marked off as contaminated. Efforts should be made to clean the area up by shoveling contents into red bags or using disinfectants to kill potential pathogen (USHHS and NIOSH 1989). Visible material should first be removed with disposable towels or other appropriate means that will ensure protection against direct contact with blood. The area should be decontaminated with a commercial disinfectant solution or a 1:100 solution of household bleach. Soiled cleaning equipment should be cleaned and decontaminated with the disinfectant solution (USHHS and NIOSH, 1989).

If a victim's clothes becomes soiled with blood during First Aid or CPR, the soiled material i.e.,clothes, resuscitation equipment or disposable towels should be placed in a red or orange plastic bag. If possible this bag should accompany the victim to the hospital or ambulance. Where on-site emergency care is given and additional medical treatment is not likely, place soiled material in a red or orange plastic bag then call a local medical disposal company.

Decontamination of the care giver is required following contact with blood or other potentially infectious materials. Work coveralls which have been soiled with blood may be laundered at a laundry facility capable of handling contaminated clothing. The laundry service must be informed of the potential contamination. The work coveralls should be placed in a red or orange bag. Site equipment which has been contaminated with blood or other infectious material shall be decontaminated. Boots and leather goods may be brush-scrubbed with soap and hot water to remove contamination.

All PPE should be removed and contained prior to leaving the work area. Hands must be washed immediately after each contact with a potentially contaminated person or articles. Use ordinary soaps. Use waterless disinfectants solution when soap and water are not available on-site. Once off-site use a restroom sink for hand washing.

10.0 Vaccination and Post-Exposure Evaluation and Follow-up

10.1 Vaccination

It is not WESTON's intent at this time to offer Hepatitis B Vaccination for First Aid providers.

Hepatitis B vaccines are 70-85% effective when give within 1 week after HBV exposure. The HBIG, a preparation of immune globulin with high levels of antibody to HBV (anti-HBs), provides temporary passive protection following exposure to HBV. Combination treatment with hepatitis B vaccine and HBIG is over 90% effective in preventing hepatitis B following a documented exposure (Center of Disease Control, 1985).

Upon suspicion or verification of exposure to blood or infectious materials, Hepatitis Vaccination will be made available to the exposed individual(s) at no cost to the employee. The employee will immediately be referred to WESTON's Occupational Medical consultants for counselling and management.

10.2 Incident Reporting

When an employee gives First Aid or CPR, or is potentially exposed to bloodborne pathogens, an Incident Report must be completed. The report must indicate the potential exposure to bloodborne pathogens. Additionally, the employee will acknowledge potential exposure to bloodborne pathogen on the Monthly Injury/Exposure Report. Reporting must comply with WESTON Operating Procedures. i.e. verbal reports must be received by Corporate Health and Safety with in 24 hours and written reports within 48 hours. WESTON standard Incident Reports will be used, but shall be clearly identified with the notation, "Potential Bloodborne Pathogen Exposure" at the top of the first page.

10.3 Post Exposure Management and Testing

Upon learning of exposure to a source or source individual found to be positive for HBsAg, WESTON's Medical Consultant will provide direction on case management

HBV and HIV testing of the source individual should be done at the Regional Office medical clinic or at the hospital where the victim was treated for injury. Local laws may apply for testing source individuals in situations where consent cannot be obtained because the source refuses testing or can not be identified (i.e., an unconscious patient). If the job location does not allow access to the Regional Office medical clinic then a new WESTON Occupational Medical Consultant will be consulted for guidance. The alternate clinic/hospital must offer pretest counseling, post test counseling and referral for treatment.

11.0 Communication of Hazards to Employees

11.1 Training Schedule

The WESTON SO's will ensure that employees who are required to provide First Aid and CPR, are trained in regards to all components of the standard upon employee assignment and at the annual refresher training. Safety Officers will also be responsible for informing First Aid Providers of task modifications or procedure changes which might affect occupational exposure.

11.2 Training Contents

A sign-up sheet as shown in Table 5 will contain the following information: attendants names, signatures, job classifications, instructors name and duration of the class.

Training will contain the following information:

- Where an accessible copy of the regulatory text and the WESTON's Exposure Control Plan can be found.
- An explanation of WESTON's exposure control plan and the means by which employees can obtain a copy of the written plan.
- A general explanation of the epidemiology and symptoms of bloodborne diseases.
- An explanation of the appropriate methods for recognizing tasks and other activities that may involve exposure to blood and other potentially infectious materials.
- An explanation of the use and limitations of methods, that will prevent or reduce exposure including appropriate engineering controls, work practices, and PPE.
- Information on the types, proper use, location, removal, handling, decontamination and disposal of PPE.
- An explanation of the basis for selection of PPE.
- An explanation of the procedure to follow if an exposure incident occurs, including the method of reporting the incident and the medical follow-up that will be made available.

References

Centers for Disease Control. Recommendations Against Viral Hepatitis. MMWR 1985; 34:313-324, 329-335.

Centers for Disease Control. Centers for Disease Control. Recommendations for Prevention of HIV Transmission in Health-Care Settings. MMWR 1987; 36 (suppl 2S).

U.S. Department of Health and Human Services and National Institute for Occupational Safety and Health. A Curriculum Guide for Public-Safety and Emergency-Response Workers. NIOSH 89-108.

Johnson and Johnson Medical Inc. Bloodborne Infections: A Practical Guide to OSHA Compliance.

EMPLOYEE FACT SHEET

HEPATITIS - Hepatitis is a liver disease, initially resulting in possible inflammation of the liver, and frequently leading to more serious conditions including cirrhosis and liver cancer. In the United States there are approximately 300,000 new cases of Hepatitis B Virus (HBV), the most prevalent form of Hepatitis, every year. While there is no cure for Hepatitis B, a vaccine does exist that can prevent infection.

HBV is most often transmitted through breaks in the skin or mucous membranes. This usually occurs through needlesticks, human bites, or having infectious material (such as blood or other body fluids) get into existing cuts or abrasions.

The symptoms of HBV infection are very much like a mild "flu". Initially, there is a sense of fatigue, possible stomach pain, loss of appetite, and even nausea. As the disease continues to develop, jaundice (a distinct yellowing of the skin) and a darkened urine will often occur. However, people who are infected with HBV will often show no symptoms for some time.

After exposure it can take 2-6 months for Hepatitis B to develop. This is extremely important, since vaccinations begun immediately after exposure to the virus can often prevent infection.

HUMAN IMMUNODEFICIENCY VIRUS - Human Immunodeficiency Virus (HIV) is the "newest" of the major bloodborne diseases. HIV is spreading rapidly, and it is estimated that by the end of 1992 over two million people in the U. S. will be infected.

Symptoms of HIV infection can vary, but often include:

- o Weakness.
- o Fever.
- o Sore Throat.
- o Nausea.
- o Headaches.
- o Diarrhea.
- o Other "flu-like" symptoms.

However, many people with the HIV virus can show no apparent symptoms for years after their infection.

In most cases, contracting the HIV virus ultimately leads to the development of Acquired Immunodeficiency Syndrome (AIDS). This results in the breakdown of the immune system, so the body does not have the ability to fight off other diseases. Currently no vaccination exists to prevent infection of HIV, and there is no known cure.

ATTACHMENT "D"

SITE SPECIFIC HAZARD COMMUNICATION PROGRAM

Location Specific Hazard Communications Program/Checklist

In order to ensure an understanding of and compliance with the Hazard Communication Standard, WESTON will utilize this checklist/document (or similiar document) in conjunction with the WESTON Written Hazard Communications Program as a means of meeting site or location specific requirements.

While responsibility for activities within this document reference the WESTON Safety Officer, it is the responsibiltiy of all personnel to effect compliance. Responsiblities under various conditions can be found within the WESTON Written Hazard Communication Program.

To ensure that information about the dangers of all hazardous chemicals used by WESTON are known by all affected employees, the following hazardous information program has been established. All affected personnel will participate in the hazard communication program. This written program as well as WESTON's Corporate Hazard Communication Program will be available for review by any employee, employee representative, representative of OSHA, NIOSH or any affected employer/employee on a multi-employer site.

___ Site or other location name/address:
Delta Shipyard/202 Industrial Blvd. Houma, Louisiana

___ Site/Project/Location Manager: Eric Tate

___ Site/Location Safety Officer: Eric Tate

___ List of chemicals complied, format: HASP:__X__ Other:_____

___ Location of MSDS Files:
In HASP

___ Training Conducted by (name and date):_____

___ Indicate format of training documentation: Field Log:_____ Other:_____

___ Client briefing conducted regarding hazard communication:

___ If multi-employer site, indicate name of affected companies:

___ Other employer(s) notified of chemicals, labelling and MSDS information:

___ WESTON notified of other employer's or clients hazard communication program as necessary.

List of Hazardous Chemicals

A list of known hazardous chemicals used by WESTON personnel must be prepared and attached to this document or in a centrally identified location with the MSDS's. Further information on each chemical may be obtained by reviewing the appropriate MSDS's. The list will be arranged to enable cross reference with the MSDS file and the label on the container. The SO or location manager is responsible for ensuring the chemical listing remains up-to-date.

Container Labeling

The WESTON Safety Officer (SO) will verify that all containers received from the chemical manufacturer, importer or distributor for use on site will be clearly labeled.

The SO is responsible for assuring labels are placed where required and for comparing MSDS's and other information with label information to ensure correctness.

Material Safety Data Sheets (MSDS)

The SO is responsible for establishing and monitoring WESTON's MSDS program for the location. The SO will make sure procedures are developed to obtain the necessary MSDS's and will review incoming MSDS's for new or significant health and safety information. He/she will see that any new information is passed on to the affected employees. If an MSDS is not received at the time of initial shipment, the SO will call the manufacturer and have a MSDS delivered for that product in accordance with the requirements of WESTON's Written Hazard Communication Program.

A log for, and copies of, MSDS's for all hazardous chemicals in use will be kept in the MSDS folder at a location known to all site workers. MSDS's will be readily available to all employees during each work shift. If an MSDS is not available, immediately contact the WESTON SO or designated alternate. When revised MSDS's are received the SO will immediately replace the old MSDS's.

Employee Training and Information

The SO is responsible for the WESTON site-specific personnel training program. The SO will ensure that all program elements specified below are supplied to all affected employees.

At the time of initial assignment for employees to the work site or whenever a new hazard is introduced into the work area employees will attend a health and safety meeting or briefing that includes the information indicated below.

- Hazardous chemicals present at the worksite
- Physical and health risks of the hazardous chemicals
- The signs and symptoms of overexposure
- Procedures to follow if employees are overexposed to hazardous chemicals
- Location of the MSDS file and written hazard communication program
- How to determine the presence or release of hazardous chemicals in the employees work area
- How to read labels and review MSDS's to obtain hazard information
- Steps WESTON has taken to reduce or prevent exposure to hazardous chemicals
- How to reduce or prevent exposure to hazardous chemicals through use of controls procedures, work practices and personal protective equipment
- Hazardous, non-routine tasks to be performed (if any)
- Chemicals within unlabled piping (if any)

Hazardous Non-Routine Tasks

When employees are required to perform hazardous non-routine tasks the affected employee(s) will be given information by the SO about the hazardous chemicals he or she may utilize during such activity. This information will include specific chemical hazards, protective and safety measures the employee can use and steps WESTON is using to reduce the hazards. These steps include, but are not limited to, ventilation, respirators, presence of another employee and emergency procedures.

Chemicals in Unlabeled Pipes

Work activities may be performed by employees in areas where chemicals are transferred through unlabeled pipes. Prior to starting work in these areas, the employee shall contact the SO at which time information as to; the chemical(s) in the pipes, potential hazards of the chemicals or the process involved, and safety precautions which should be taken will be determined and presented.

Multi-Employer Worksites

It is the responsibility of the SO to provide other employers with information about hazardous chemicals imported by WESTON to which their employees may be exposed, along with suggested safety precautions. It is also the responsibility of SO and the site manager to obtain information about hazardous chemicals used by other employers to which WESTON employees may be exposed. WESTON's chemical listing will be made available to other employers as requested. MSDS's will be available for viewing as necessary.

The location, format and/or procedures for accessing MSDS information must be relayed to affected employees.

APPENDIX C

SAMPLING PROCEDURES

EPA/540/P-91/006
OSWER Directive 9360.4-02
January 1991

COMPENDIUM OF ERT SOIL SAMPLING AND SURFACE GEOPHYSICS PROCEDURES

Sampling Equipment Decontamination

Soil Sampling

Soil Gas Sampling

General Surface Geophysics

Interim Final

Environmental Response Team
Emergency Response Division

Office of Emergency and Remedial Response
U.S. Environmental Protection Agency
Washington, DC 20460

1.0 SAMPLING EQUIPMENT DECONTAMINATION: SOP #2006

1.1 SCOPE AND APPLICATION

This Standard Operating Procedure (SOP) describes methods used for preventing or reducing cross-contamination, and provides general guidelines for sampling equipment decontamination procedures at a hazardous waste site. Preventing or minimizing cross-contamination in sampled media and in samples is important for preventing the introduction of error into sampling results and for protecting the health and safety of site personnel.

Removing or neutralizing contaminants that have accumulated on sampling equipment ensures protection of personnel from permeating substances, reduces or eliminates transfer of contaminants to clean areas, prevents the mixing of incompatible substances, and minimizes the likelihood of sample cross-contamination.

1.2 METHOD SUMMARY

Contaminants can be physically removed from equipment, or deactivated by sterilization or disinfection. Gross contamination of equipment requires physical decontamination, including abrasive and non-abrasive methods. These include the use of brushes, air and wet blasting, and high-pressure water cleaning, followed by a wash/rinse process using appropriate cleaning solutions. Use of a solvent rinse is required when organic contamination is present.

1.3 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

This section is not applicable to this SOP.

1.4 INTERFERENCES AND POTENTIAL PROBLEMS

- The use of distilled/deionized water commonly available from commercial vendors may be acceptable for decontamination of sampling equipment provided that it has been verified by laboratory analysis to be analyte free.

- An untreated potable water supply is not an acceptable substitute for tap water. Tap water may be used from any municipal water treatment system for mixing of decontamination solutions.

- Acids and solvents utilized in the decontamination sequence pose the health and safety risks of inhalation or skin contact, and raise shipping concerns of permeation or degradation.

- The site work plan must address disposal of the spent decontamination solutions.

- Several procedures can be established to minimize contact with waste and the potential for contamination. For example:

  - Stress work practices that minimize contact with hazardous substances.

  - Use remote sampling, handling, and container-opening techniques when appropriate.

  - Cover monitoring and sampling equipment with protective material to minimize contamination.

  - Use disposable outer garments and disposable sampling equipment when appropriate.

1.5 EQUIPMENT/APPARATUS

- appropriate personal protective clothing
- non-phosphate detergent
- selected solvents
- long-handled brushes
- drop cloths/plastic sheeting
- trash container
- paper towels
- galvanized tubs or buckets
- tap water

- distilled/deionized water
- metal/plastic containers for storage and disposal of contaminated wash solutions
- pressurized sprayers for tap and deionized/distilled water
- sprayers for solvents
- trash bags
- aluminum foil
- safety glasses or splash shield
- emergency eyewash bottle

1.6 REAGENTS

There are no reagents used in this procedure aside from the actual decontamination solutions and solvents. In general, the following solvents are utilized for decontamination purposes:

- 10% nitric acid[1]
- acetone (pesticide grade)[2]
- hexane (pesticide grade)[2]
- methanol

[1] Only if sample is to be analyzed for trace metals.
[2] Only if sample is to be analyzed for organics.

1.7 PROCEDURES

As part of the health and safety plan, develop and set up a decontamination plan before any personnel or equipment enter the areas of potential exposure. The equipment decontamination plan should include:

- the number, location, and layout of decontamination stations
- which decontamination apparatus is needed
- the appropriate decontamination methods
- methods for disposal of contaminated clothing, apparatus, and solutions

1.7.1 Decontamination Methods

All personnel, samples, and equipment leaving the contaminated area of a site must be decontaminated. Various decontamination methods will either physically remove contaminants, inactivate contaminants by disinfection or sterilization, or do both.

In many cases, gross contamination can be removed by physical means. The physical decontamination techniques appropriate for equipment decontamination can be grouped into two categories: abrasive methods and non-abrasive methods.

Abrasive Cleaning Methods

Abrasive cleaning methods work by rubbing and wearing away the top layer of the surface containing the contaminant. The following abrasive methods are available:

- Mechanical: Mechanical cleaning methods use brushes of metal or nylon. The amount and type of contaminants removed will vary with the hardness of bristles, length of brushing time, and degree of brush contact.

- Air Blasting: Air blasting is used for cleaning large equipment, such as bulldozers, drilling rigs or auger bits. The equipment used in air blast cleaning employs compressed air to force abrasive material through a nozzle at high velocities. The distance between the nozzle and the surface cleaned, as well as the pressure of air, the time of application, and the angle at which the abrasive strikes the surface, determines cleaning efficiency. Air blasting has several disadvantages: it is unable to control the amount of material removed, it can aerate contaminants, and it generates large amounts of waste.

- Wet Blasting: Wet blast cleaning, also used to clean large equipment, involves use of a suspended fine abrasive delivered by compressed air to the contaminated area. The amount of materials removed can be carefully controlled by using very fine abrasives. This method generates a large amount of waste.

Non-Abrasive Cleaning Methods

Non-abrasive cleaning methods work by forcing the contaminant off of a surface with pressure. In general, less of the equipment surface is removed using non-abrasive methods. The following non-abrasive methods are available:

- High-Pressure Water: This method consists of a high-pressure pump, an operator-controlled directional nozzle, and a high pressure hose. Operating pressure usually ranges from 340 to 680 atmospheres (atm) which relates to flow rates of 20 to 140 liters per minute.

- Ultra-High-Pressure Water: This system produces a pressurized water jet (from 1,000 to 4,000 atm). The ultra-high-pressure spray removes tightly-adhered surface film. The water velocity ranges from 500 m/sec (1,000 atm) to 900 m/sec (4,000 atm). Additives can enhance the method. This method is not applicable for hand-held sampling equipment.

Disinfection/Rinse Methods

- Disinfection: Disinfectants are a practical means of inactivating infectious agents.

- Sterilization: Standard sterilization methods involve heating the equipment. Sterilization is impractical for large equipment.

- Rinsing: Rinsing removes contaminants through dilution, physical attraction, and solubilization.

1.7.2 Field Sampling Equipment Cleaning Procedures

Solvent rinses are not necessarily required when organics are not a contaminant of concern and may be eliminated from the sequence specified below. Similarly, an acid rinse is not required if analysis does not include inorganics.

1. Where applicable, follow physical removal procedures specified in section 1.7.1.
2. Wash equipment with a non-phosphate detergent solution.
3. Rinse with tap water.
4. Rinse with distilled/deionized water.
5. Rinse with 10% nitric acid if the sample will be analyzed for trace organics.
6. Rinse with distilled/deionized water.
7. Use a solvent rinse (pesticide grade) if the sample will be analyzed for organics.
8. Air dry the equipment completely.
9. Rinse again with distilled/deionized water.

Selection of the solvent for use in the decontamination process is based on the contaminants present at the site. Use of a solvent is required when organic contamination is present on-site. Typical solvents used for removal of organic contaminants include acetone, hexane, or water. An acid rinse step is required if metals are present on-site. If a particular contaminant fraction is not present at the site, the nine-step decontamination procedure listed above may be modified for site specificity. The decontamination solvent used should not be among the contaminants of concern at the site.

Table 1 lists solvent rinses which may be required for elimination of particular chemicals. After each solvent rinse, the equipment should be air dried and rinsed with distilled/deionized water.

Sampling equipment that requires the use of plastic tubing should be disassembled and the tubing replaced with clean tubing, before commencement of sampling and between sampling locations.

1.8 CALCULATIONS

This section is not applicable to this SOP.

1.9 QUALITY ASSURANCE/ QUALITY CONTROL

One type of quality control sample specific to the field decontamination process is the rinsate blank. The rinsate blank provides information on the effectiveness of the decontamination process employed in the field. When used in conjunction with field blanks and trip blanks, a rinsate blank can detect contamination during sample handling, storage and sample transportation to the laboratory.

Table 1: Recommended Solvent Rinse for Soluble Contaminants

SOLVENT	SOLUBLE CONTAMINANTS
Water	• Low-chain hydrocarbons • Inorganic compounds • Salts • Some organic acids and other polar compounds
Dilute Acids	• Basic (caustic) compounds • Amines • Hydrazines
Dilute Bases – for example, detergent and soap	• Metals • Acidic compounds • Phenol • Thiols • Some nitro and sulfonic compounds
Organic Solvents[1] - for example, alcohols, ethers, ketones, aromatics, straight-chain alkanes (e.g., hexane), and common petroleum products (e.g., fuel, oil, kerosene)	• Nonpolar compounds (e.g., some organic compounds)

[1] - WARNING: Some organic solvents can permeate and/or degrade protective clothing.

A rinsate blank consists of a sample of analyte-free (i.e, deionized) water which is passed over and through a field decontaminated sampling device and placed in a clean sample container.

Rinsate blanks should be run for all parameters of interest at a rate of 1 per 20 for each parameter, even if samples are not shipped that day. Rinsate blanks are not required if dedicated sampling equipment is used.

1.10 DATA VALIDATION

This section is not applicable to this SOP.

1.11 HEALTH AND SAFETY

When working with potentially hazardous materials, follow U.S. EPA, OSHA and specific health and safety procedures.

Decontamination can pose hazards under certain circumstances even though performed to protect health and safety. Hazardous substances may be incompatible with decontamination methods. For example, the decontamination solution or solvent may react with contaminants to produce heat, explosion, or toxic products. Decontamination methods may be incompatible with clothing or equipment: some solvents can permeate or degrade protective clothing. Also, decontamination solutions and solvents may pose a direct health hazard to workers through inhalation or skin contact, or if they combust.

The decontamination solutions and solvents must be determined to be compatible before use. Any method that permeates, degrades, or damages personal protective equipment should not be used. If decontamination methods pose a direct health hazard, measures should be taken to protect personnel or the methods should be modified to eliminate the hazard.

2.0 SOIL SAMPLING: SOP #2012

2.1 SCOPE AND APPLICATION

The purpose of this Standard Operating Procedure (SOP) is to describe the procedures for collecting representative soil samples. Analysis of soil samples may determine whether concentrations of specific soil pollutants exceed established action levels, or if the concentrations of soil pollutants present a risk to public health, welfare, or the environment.

2.2 METHOD SUMMARY

Soil samples may be collected using a variety of methods and equipment. The methods and equipment used are dependent on the depth of the desired sample, the type of sample required (disturbed versus undisturbed), and the type of soil. Near-surface soils may be easily sampled using a spade, trowel, and scoop. Sampling at greater depths may be performed using a hand auger, a trier, a split-spoon, or, if required, a backhoe.

2.3 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

Chemical preservation of solids is not generally recommended. Refrigeration to 4°C, supplemented by a minimal holding time, is usually the best approach.

2.4 INTERFERENCES AND POTENTIAL PROBLEMS

There are two primary interferences or potential problems associated with soil sampling. These include cross-contamination of samples and improper sample collection. Cross-contamination problems can be eliminated or minimized through the use of dedicated sampling equipment. If this is not possible or practical, then decontamination of sampling equipment is necessary. Improper sample collection can involve using contaminated equipment, disturbance of the matrix resulting in compaction of the sample, or inadequate homogenization of the samples where required, resulting in variable, non-representative results.

2.5 EQUIPMENT/APPARATUS

- sampling plan
- maps/plot plan
- safety equipment, as specified in the health and safety plan
- compass
- tape measure
- survey stakes or flags
- camera and film
- stainless steel, plastic, or other appropriate homogenization bucket or bowl
- 1-quart mason jars w/Teflon liners
- Ziploc plastic bags
- logbook
- labels
- chain of custody forms and seals
- field data sheets
- cooler(s)
- ice
- decontamination supplies/equipment
- canvas or plastic sheet
- spade or shovel
- spatula
- scoop
- plastic or stainless steel spoons
- trowel
- continuous flight (screw) auger
- bucket auger
- post hole auger
- extension rods
- T-handle
- sampling trier
- thin-wall tube sampler
- Vehimeyer soil sampler outfit
  - tubes
  - points
  - drive head
  - drop hammer
  - puller jack and grip
- backhoe

2.6 REAGENTS

Reagents are not used for the preservation of soil samples. Decontamination solutions are specified in

ERT SOP #2006, Sampling Equipment Decontamination.

2.7 PROCEDURES

2.7.1 Preparation

1. Determine the extent of the sampling effort, the sampling methods to be employed, and which equipment and supplies are required.

2. Obtain necessary sampling and monitoring equipment.

3. Decontaminate or preclean equipment, and ensure that it is in working order.

4. Prepare schedules, and coordinate with staff, client, and regulatory agencies, if appropriate.

5. Perform a general site survey prior to site entry in accordance with the site-specific health and safety plan.

6. Use stakes, buoys, or flagging to identify and mark all sampling locations. Consider specific site factors, including extent and nature of contaminant, when selecting sample location. If required, the proposed locations may be adjusted based on site access, property boundaries, and surface obstructions. All staked locations will be utility-cleared by the property owner prior to soil sampling.

2.7.2 Sample Collection

Surface Soil Samples

Collect samples from near-surface soil with tools such as spades, shovels, and scoops. Surface material can be removed to the required depth with this equipment, then a stainless steel or plastic scoop can be used to collect the sample.

This method can be used in most soil types but is limited to sampling near surface areas. Accurate, representative samples can be collected with this procedure depending on the care and precision demonstrated by the sampling team member. The use of a flat, pointed mason trowel to cut a block of the desired soil can be helpful when undisturbed profiles are required. A stainless steel scoop, lab spoon, or plastic spoon will suffice in most other applications. Avoid the use of devices plated with chrome or other materials. Plating is particularly common with garden implements such as potting trowels.

Follow these procedures to collect surface soil samples.

1. Carefully remove the top layer of soil or debris to the desired sample depth with a pre-cleaned spade.

2. Using a pre-cleaned, stainless steel scoop, plastic spoon, or trowel, remove and discard a thin layer of soil from the area which came in contact with the spade.

3. If volatile organic analysis is to be performed, transfer a portion of the sample directly into an appropriate, labeled sample container(s) with a stainless steel lab spoon, plastic lab spoon, or equivalent and secure the cap(s) tightly. Place the remainder of the sample into a stainless steel, plastic, or other appropriate homogenization container, and mix thoroughly to obtain a homogenous sample representative of the entire sampling interval. Then, either place the sample into an appropriate, labeled container(s) and secure the cap(s) tightly; or, if composite samples are to be collected, place a sample from another sampling interval into the homogenization container and mix thoroughly. When compositing is complete, place the sample into appropriate, labeled container(s) and secure the cap(s) tightly.

Sampling at Depth with Augers and Thin-Wall Tube Samplers

This system consists of an auger, a series of extensions, a "T" handle, and a thin-wall tube sampler (Appendix A, Figure 1). The auger is used to bore a hole to a desired sampling depth, and is then withdrawn. The sample may be collected directly from the auger. If a core sample is to be collected, the auger tip is then replaced with a thin-wall tube sampler. The system is then lowered down the borehole, and driven into the soil at the completion depth. The system is withdrawn and the core collected from the thin-wall tube sampler.

Several types of augers are available. These include: bucket, continuous flight (screw), and posthole augers. Bucket augers are better for direct

sample recovery since they provide a large volume of sample in a short time. When continuous flight augers are used, the sample can be collected directly from the flights, which are usually at 5-feet intervals. The continuous flight augers are satisfactory for use when a composite of the complete soil column is desired. Posthole augers have limited utility for sample collection as they are designed to cut through fibrous, rooted, swampy soil.

Follow these procedures for collecting soil samples with the auger and a thin-wall tube sampler.

1. Attach the auger bit to a drill rod extension, and attach the "T" handle to the drill rod.

2. Clear the area to be sampled of any surface debris (e.g., twigs, rocks, litter). It may be advisable to remove the first 3 to 6 inches of surface soil for an area approximately 6 inches in radius around the drilling location.

3. Begin augering, periodically removing and depositing accumulated soils onto a plastic sheet spread near the hole. This prevents accidental brushing of loose material back down the borehole when removing the auger or adding drill rods. It also facilitates refilling the hole, and avoids possible contamination of the surrounding area.

4. After reaching the desired depth, slowly and carefully remove the auger from boring. When sampling directly from the auger, collect sample after the auger is removed from boring and proceed to Step 10.

5. Remove auger tip from drill rods and replace with a pre-cleaned thin-wall tube sampler. Install proper cutting tip.

6. Carefully lower the tube sampler down the borehole. Gradually force the tube sampler into the soil. Care should be taken to avoid scraping the borehole sides. Avoid hammering the drill rods to facilitate coring as the vibrations may cause the boring walls to collapse.

7. Remove the tube sampler, and unscrew the drill rods.

8. Remove the cutting tip and the core from the device.

9. Discard the top of the core (approximately 1 inch), as this represents material collected before penetration of the layer of concern. Place the remaining core into the appropriate labeled sample container(s). Sample homogenization is not required.

10. If volatile organic analysis is to be performed, transfer a portion of the sample directly into an appropriate, labeled sample container(s) with a stainless steel lab spoon, plastic lab spoon, or equivalent and secure the cap(s) tightly. Place the remainder of the sample into a stainless steel, plastic, or other appropriate homogenization container, and mix thoroughly to obtain a homogeneous sample representative of the entire sampling interval. Then, either place the sample into an appropriate, labeled container(s) and secure the cap(s) tightly; or, if composite samples are to be collected, place a sample from another sampling interval into the homogenization container and mix thoroughly. When compositing is complete, place the sample into the appropriate, labeled container(s) and secure the cap(s) tightly.

11. If another sample is to be collected in the same hole, but at a greater depth, reattach the auger bit to the drill and assembly, and follow steps 3 through 11, making sure to decontaminate the auger and tube sampler between samples.

12. Abandon the hole according to applicable state regulations. Generally, shallow holes can simply be backfilled with the removed soil material.

Sampling at Depth with a Trier

The system consists of a trier, and a "T" handle. The auger is driven into the soil to be sampled and used to extract a core sample from the appropriate depth.

Follow these procedures to collect soil samples with a sampling trier.

1. Insert the trier (Appendix A, Figure 2) into the material to be sampled at a 0° to 45° angle from horizontal. This orientation minimizes the spillage of sample.

2. Rotate the trier once or twice to cut a core of material.

PB91-921274

OSWER Directive 9360.4-03
January 1991

COMPENDIUM OF ERT SURFACE WATER AND SEDIMENT SAMPLING PROCEDURES

Sampling Equipment Decontamination

Surface Water Sampling

Sediment Sampling

Interim Final

Environmental Response Team
Emergency Response Division

Office of Emergency and Remedial Response
U.S. Environmental Protection Agency
Washington, DC 20460

2.0 SURFACE WATER SAMPLING: SOP #2013

2.1 SCOPE AND APPLICATION

This Standard Operating Procedure (SOP) is applicable to the collection of representative liquid samples, both aqueous and nonaqueous from streams, rivers, lakes, ponds, lagoons, and surface impoundments. It includes samples collected from depth, as well as samples collected from the surface.

2.2 METHOD SUMMARY

Sampling situations vary widely and therefore no universal sampling procedure can be recommended.

However, sampling of both aqueous and non-aqueous liquids from the above mentioned sources is generally accomplished through the use of one of the following samplers or techniques:

- Kemmerer bottle
- bacon bomb sampler
- dip sampler
- direct method

These sampling techniques will allow for the collection of representative samples from the majority of surface waters and impoundments encountered.

2.3 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

Once samples have been collected, follow these procedures:

1. Transfer the sample(s) into suitable labeled sample containers.
2. Preserve the sample if appropriate, or use pre-preserved sample bottles.
3. Cap the container, put it in a Ziploc plastic bag and place it on ice in a cooler.
4. Record all pertinent data in the site logbook and on a field data sheet.
5. Complete the chain of custody form.
6. Attach custody seals to the cooler prior to shipment.
7. Decontaminate all sampling equipment prior to the collection of additional samples.

2.4 INTERFERENCES AND POTENTIAL PROBLEMS

There are two primary interferences or potential problems with surface water sampling. These include cross-contamination of samples and improper sample collection.

- Cross-contamination problems can be eliminated or minimized through the use of dedicated sampling equipment. If this is not possible or practical, then decontamination of sampling equipment is necessary. Refer to ERT SOP #2006, Sampling Equipment Decontamination.
- Improper sample collection can involve using contaminated equipment, disturbance of the stream or impoundment substrate, and sampling in an obviously disturbed area.

Following proper decontamination procedures and minimizing disturbance of the sample site will eliminate these problems.

2.5 EQUIPMENT/APPARATUS

Equipment needed for collection of surface water samples includes:

- Kemmerer bottles
- bacon bomb sampler
- dip sampler
- line and messengers
- sample bottle preservatives
- Ziploc bags
- ice
- cooler(s)
- chain of custody forms, field data sheets

1. Using a properly decontaminated Kemmerer bottle, set the sampling device so that the sampling end pieces are pulled away from the sampling tube, allowing the substance to be sampled to pass through this tube.

2. Lower the pre-set sampling device to the predetermined depth. Avoid bottom disturbance.

3. When the Kemmerer bottle is at the required depth, send down the messenger, closing the sampling device.

4. Retrieve the sampler and discharge the first 10 to 20 mL to clear any potential contamination on the valve. Transfer the sample to the appropriate sample container.

Bacon Bomb Sampler

A bacon bomb sampler (Figure 2, Appendix A) may be used in similar situations to those outlined for the Kemmerer bottle. Sampling procedures are as follows:

1. Lower the bacon bomb sampler carefully to the desired depth, allowing the line for the trigger to remain slack at all times. When the desired depth is reached, pull the trigger line until taut.

2. Release the trigger line and retrieve the sampler.

3. Transfer the sample to the appropriate sample container by pulling the trigger.

Dip Sampler

A dip sampler (Figure 3, Appendix A) is useful for situations where a sample is to be recovered from an outfall pipe or along a lagoon bank where direct access is limited. The long handle on such a device allows access from a discrete location. Sampling procedures are as follows:

1. Assemble the device in accordance with the manufacturer's instructions.

2. Extend the device to the sample location and collect the sample.

3. Retrieve the sampler and transfer the sample to the appropriate sample container.

Direct Method

For streams, rivers, lakes, and other surface waters, the direct method may be utilized to collect water samples from the surface. This method is not to be used for sampling lagoons or other impoundments where contact with contaminants are a concern.

Using adequate protective clothing, access the sampling station by appropriate means. For shallow stream stations, collect the sample under the water surface pointing the sample container upstream. The container must be upstream of the collector. Avoid disturbing the substrate. For lakes and other impoundments, collect the sample under the water surface avoiding surface debris and the boat wake.

When using the direct method, do not use pre-preserved sample bottles as the collection method may dilute the concentration of preservative necessary for proper sample preservation.

2.8 CALCULATIONS

This section is not applicable to this SOP.

2.9 QUALITY ASSURANCE/ QUALITY CONTROL

There are no specific quality assurance activities which apply to the implementation of these procedures. However, the following general QA/QC procedures apply:

- All data must be documented on field data sheets or within site logbooks.

- All instrumentation must be operated in accordance with operating instructions as supplied by the manufacturer, unless otherwise specified in the work plan. Equipment checkout and calibration activities must occur prior to sampling/operation and they must be documented.

2.10 DATA VALIDATION

This section is not applicable to this SOP.

3.0 SEDIMENT SAMPLING: SOP #2016

3.1 SCOPE AND APPLICATION

This Standard Operating Procedure (SOP) is applicable to the collection of representative sediment samples. Analysis of sediment may determine whether concentrations of specific contaminants exceed established threshold action levels, or if the concentrations present a risk to public health, welfare, or the environment.

The methodologies discussed in this procedure are applicable to the sampling of sediment in both flowing and standing water. They are generic in nature and may be modified in whole or part to meet the handling and analytical requirements of the contaminants of concern, as well as the constraints presented by the sampling area. However, if modifications occur, they should be documented in the site logbook or report summarizing field activities.

For the purposes of this procedure, sediments are those mineral and organic materials situated beneath an aqueous layer. The aqueous layer may be either static, as in lakes, ponds, or other impoundments or flowing, as in rivers and streams.

3.2 METHOD SUMMARY

Sediment samples may be recovered using a variety of methods and equipment, depending on the depth of the aqueous layer, the portion of the sediment profile required (surface versus subsurface), the type of sample required (disturbed versus undisturbed) and the sediment type.

Sediment is collected from beneath an aqueous layer either directly, using a hand-held device such as a shovel, trowel, or auger, or indirectly using a remotely activated device such as an Ekman or Ponar dredge. Following collection, the sediment is placed into a container constructed of inert material, homogenized, and transferred to the appropriate sample containers. The homogenization procedure should not be used if sample analysis includes volatile organics.

3.3 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

- Chemical preservation of solids is generally not recommended. Cooling is usually the best approach, supplemented by the appropriate holding time.

- Wide-mouth glass containers with Teflon-lined caps are utilized for sediment samples. The sample volume is a function of the analytical requirements and will be specified in the work plan.

- Transfer sediment from the sample collection device to an appropriate sample container using a stainless steel or plastic lab spoon or equivalent. If composite samples are collected, place the sediment sample in a stainless steel, plastic or other appropriate composition (e.g.: Teflon) bucket, and mix thoroughly to obtain a homogeneous sample representative of the entire sampling interval. Then place the sediment sample into labeled containers.

- Samples for volatile organic analysis must be collected directly from the bucket, before mixing the sample, to minimize loss due to volatilization of contaminants.

- All sampling devices should be decontaminated, then wrapped in aluminum foil. The sampler should remain in this wrapping until it is needed. Each sampler should be used for only one sample. Dedicated samplers for sediment samples may be impractical due to the large number of sediment samples which may be required and the cost of the sampler. In this case, samplers should be cleaned in the field using the decontamination procedure described in ERT SOP# 2006, Sampling Equipment Decontamination.

tools such as spades, shovels, and scoops. Surface material can be removed to the required depth; then a stainless steel or plastic scoop should be used to collect the sample.

This method can be used to collect consolidated sediments but is limited somewhat by the depth of the aqueous layer. Accurate, representative samples can be collected with this procedure depending on the care and precision demonstrated by the sample team member. A stainless steel or plastic scoop or lab spoon will suffice in most applications. Care should be exercised to avoid the use of devices plated with chrome or other materials. Plating is particularly common with garden trowels.

Follow these procedures to collect sediment samples with a scoop or trowel:

1. Using a precleaned stainless steel scoop or trowel, remove the desired thickness of sediment from the sampling area.

2. Transfer the sample into an appropriate sample or homogenization container.

Sampling Surface Sediments with a Thin-Wall Tube Auger From Beneath a Shallow Aqueous Layer

This system consists of an auger, a series of extension rods, and a "T" handle (see Figure 4, Appendix A). The auger is driven into the sediment and used to extract a core. A sample of the core is taken from the appropriate depth.

Use the following procedure to collect sediment samples with a thin-walled auger:

1. Insert the auger into the material to be sampled at a 0° to 45° angle from vertical. This orientation minimizes spillage of the sample from the sampler. Extraction of samples may require tilting of the sampler.

2. Rotate the auger once or twice to cut a core of material.

3. Slowly withdraw the auger, making sure that the slot is facing upward.

4. An acetate core may be inserted into the auger prior to sampling, if characteristics of the sediments or body of water warrant. By using this technique, an intact core can be extracted.

5. Transfer the sample into an appropriate sample or homogenization container.

Sampling Deep Sediments with Augers and Thin-Wall Tube Samplers From Beneath a Shallow Aqueous Layer

This system uses an auger, a series of extension rods, a "T" handle, and a thin-wall tube sampler (Figure 4, Appendix A). The auger bores a hole to a desired sampling depth and then is withdrawn. The auger tip is then replaced with a tube core sampler, lowered down the borehole, and driven into the sediment at the completion depth. The core is then withdrawn and the sample collected. This method can be used to collect consolidated sediments, but is somewhat limited by the depth of the aqueous layer.

Several augers are available which include bucket and posthole augers. Bucket augers are better for direct sample recovery, are fast, and provide a large volume of sample. Posthole augers have limited utility for sample collection as they are designed more for their ability to cut through fibrous, rooted, swampy areas.

Follow these procedures to collect sediment samples with a hand auger:

1. Attach the auger bit to a drill extension rod, then attach the "T" handle to the drill extension rod.

2. Clear the area to be sampled of any surface debris.

3. Begin augering, periodically removing any accumulated sediment from the auger bucket.

4. After reaching the desired depth, slowly and carefully remove the auger from boring. (When sampling directly from the auger, collect sample after the auger is removed from boring and proceed to Step 10.)

5. Remove auger tip from drill rods and replace with a precleaned thin-wall tube sampler. Install proper cutting tip.

6. Carefully lower tube sampler down borehole. Gradually force tube sampler into sediment.

subsurface sediments. It consists of a coring device, handle, and acetate core utilized in the following procedure:

1. Assemble the coring device by inserting the acetate core into the sampling tube.

2. Insert the "eggshell" check valve mechanisms into the tip of the sampling tube with the convex surface positioned inside the acetate core.

3. Screw the coring point onto the tip of the sampling tube.

4. Screw the handle onto the upper end of the sampling tube and add extension rods as needed.

5. Place the sampler in a perpendicular position on the material to be sampled.

6. This sampler may be used with either a drive hammer for firm consolidated sediments, or a "T" handle for soft sediments. If the "T" handle is used, place downward pressure on the device until the desired depth is reached. Rotate the sampler to shear off the core of the bottom, retrieve the device and proceed to Step 15.

7. If the drive hammer is selected, insert the tapered handle (drive head) of the drive hammer through the drive head.

8. With left hand holding the tube, drive the sampler into the material to the desired depth. Do not drive the tube further than the tip of the hammer's guide.

9. Record the length of the tube that penetrated the sample material, and the number of blows required to obtain this depth.

10. Remove the drive hammer and fit the keyhole-like opening on the flat side of the hammer onto the drive head. In this position, the hammer serves as a handle for the sampler.

11. Rotate the sampler at least two revolutions to shear off the sample at the bottom.

12. Lower the sampler handle (hammer) until it just clears the two ear-like protrusions on the drive head, and rotate about 90°.

13. Withdraw the sampler by pulling the handle (hammer) upwards and dislodging the hammer from the sampler.

14. Unscrew the coring point and remove the "eggshell" check valve.

15. Slide the acetate core out of the sampler tube. The acetate core may be capped at both ends. The sample may be used in this fashion, or the contents transferred to a stainless steel or plastic bucket and mixed thoroughly to obtain a homogeneous sample representative of the entire sampling interval.

16. Samples for volatile organic analysis must be collected directly from the bucket before mixing the sample to minimize volatilization of contaminants.

3.8 CALCULATIONS

This section is not applicable to this SOP.

3.9 QUALITY ASSURANCE/ QUALITY CONTROL

There are no specific quality assurance activities which apply to the implementation of these procedures. However, the following QA/QC procedures apply:

1. All data must be documented on field data sheets or within site logbooks.

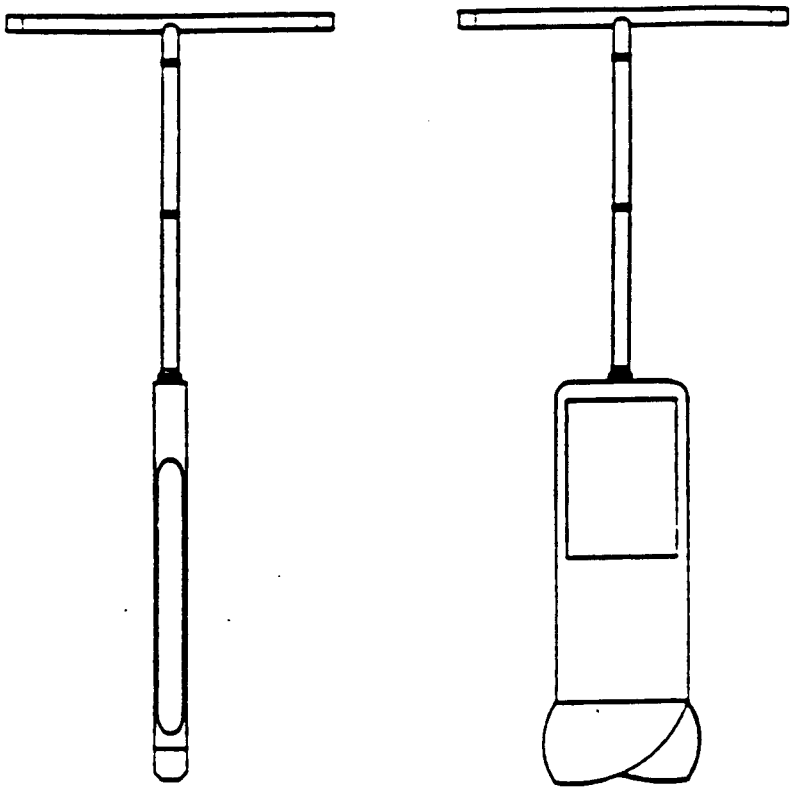
2. All instrumentation must be operated in accordance with operating instructions as supplied by the manufacturer, unless otherwise specified in the work plan. Equipment checkout and calibration activities must occur prior to sampling/operation, and they must be documented.

3.10 DATA VALIDATION

This section is not applicable to this SOP.

Figure 4: Sampling Auger

SOP #2016



Preceding page blank

EPA/540/P-91/007
OSWER Directive 9360.4-06
January 1991

COMPENDIUM OF ERT GROUNDWATER SAMPLING PROCEDURES

Sampling Equipment Decontamination

Groundwater Well Sampling

Soil Gas Sampling

Monitoring Well Installation

Water Level Measurement

Well Development

Controlled Pumping Test

Slug Test

Interim Final

Environmental Response Team
Emergency Response Division

Office of Emergency and Remedial Response
U.S. Environmental Protection Agency
Washington, DC 20460

2.0 GROUNDWATER WELL SAMPLING: SOP #2007

2.1 SCOPE AND APPLICATION

The objective of this Standard Operating Procedure (SOP) is to provide general reference information on sampling of groundwater wells. This guideline is primarily concerned with the collection of water samples from the saturated zone of the subsurface. Every effort must be made to ensure that the sample is representative of the particular zone of water being sampled. These procedures are designed to be used in conjunction with analyses for the most common types of groundwater contaminants (e.g., volatile and semi-volatile organic compounds, pesticides, metals, biological parameters).

2.2 METHOD SUMMARY

Prior to sampling a monitoring well, the well must be purged. This may be done with a number of instruments. The most common of these are the bailer, submersible pump, non-gas contact bladder pump and inertia pump. At a minimum, three well volumes should be purged, if possible. Equipment must be decontaminated prior to use and between wells. Once purging is completed and the correct laboratory-cleaned sample containers have been prepared, sampling may proceed. Sampling may be conducted with any of the above instruments, and need not be the same as the device used for purging. Care should be taken when choosing the sampling device as some will affect the integrity of the sample. Sampling equipment must also be decontaminated. Sampling should occur in a progression from the least to most contaminated well, if this information is known.

2.3 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

The type of analysis for which a sample is being collected determines the type of bottle, preservative, holding time, and filtering requirements. Samples should be collected directly from the sampling device into appropriate laboratory-cleaned containers. Check that a Teflon liner is present in the cap, if required. Attach a sample identification label. Complete a field data sheet, a chain of custody form and record all pertinent data in the site logbook.

Samples shall be appropriately preserved, labelled, logged, and placed in a cooler to be maintained at 4°C. Samples must be shipped well before the holding time is over and ideally should be shipped within 24 hours of sample collection. It is imperative that these samples be shipped or delivered daily to the analytical laboratory in order to maximize the time available for the laboratory to perform the analysis. The bottles should be shipped with adequate packing and cooling to ensure that they arrive intact.

Certain conditions may require special handling techniques. For example, treatment of a sample for volatile organic (VOA) analysis with sodium thiosulfate preservative is required if there is residual chlorine in the water (such as public water supply) that could cause free radical chlorination and change the identity of the original contaminants. However, sodium thiosulfate should not be used if chlorine is not present in the water. Special requirements must be determined prior to conducting fieldwork.

2.4 INTERFERENCES AND POTENTIAL PROBLEMS

2.4.1 General

The primary goal of groundwater sampling is to obtain a representative sample of the groundwater body. Analysis can be compromised by field personnel in two primary ways: (1) taking an unrepresentative sample, or (2) by incorrect handling of the sample. There are numerous ways of introducing foreign contaminants into a sample, and these must be avoided by following strict sampling procedures and only utilizing trained field personnel.

2.4.2 Purging

In a non-pumping well, there will be little or no vertical mixing of the water, and stratification will

occur. The well water in the screened section will mix with the groundwater due to normal flow patterns, but the well water above the screened section will remain isolated, become stagnant and lack the VOAs representative of the groundwater. Sampling personnel should realize that stagnant water may contain foreign material inadvertently or deliberately introduced from the surface, resulting in an unrepresentative sample. To safeguard against collecting nonrepresentative stagnant water, follow these guidelines during sampling:

- As a general rule, all monitoring wells should be pumped or bailed prior to sampling. Purge water should be containerized on site or handled as specified in the site-specific project plan. Evacuation of a minimum of one volume of water in the well casing, and preferably three to five volumes, is recommended for a representative sample. In a high-yielding ground water formation and where there is no stagnant water in the well above the screened section, evacuation prior to sample withdrawal is not as critical. However, in all cases where the monitoring data is to be used for enforcement actions, evacuation is recommended.

- For wells that can be pumped or bailed to dryness with the equipment being used, the well should be evacuated and allowed to recover prior to sample withdrawal. If the recovery rate is fairly rapid and the schedule allows, evacuation of more than one volume of water is preferred. If recovery is slow, sample the well upon recovery after one evacuation.

- A nonrepresentative sample can also result from excessive pre-pumping of the monitoring well. Stratification of the leachate concentration in the groundwater formation may occur, or heavier-than-water compounds may sink to the lower portions of the aquifer. Excessive pumping can dilute or increase the contaminant concentrations from what is representative of the sampling point of interest.

2.4.3 Materials

Samplers and evacuation equipment (bladders, pumps, bailers, tubing, etc.) should be limited to those made with stainless steel, Teflon, and glass in areas where concentrations are expected to be at or near the detection limit. The tendency of organics to leach into and out of many materials make the selection of materials critical for trace analyses. The use of plastics, such as PVC or polyethylene, should be avoided when analyzing for organics. However, PVC may be used for evacuation equipment as it will not come in contact with the sample.

Table 2 on page 7 discusses the advantages and disadvantages of certain equipment.

2.5 EQUIPMENT/APPARATUS

2.5.1 General

- water level indicator
  - electric sounder
  - steel tape
  - transducer
  - reflection sounder
  - airline
- depth sounder
- appropriate keys for well cap locks
- steel brush
- HNU or OVA (whichever is most appropriate)
- logbook
- calculator
- field data sheets
- chain of custody forms
- forms and seals
- sample containers
- Engineer's rule
- sharp knife (locking blade)
- tool box (to include at least: screwdrivers, pliers, hacksaw, hammer, flashlight, adjustable wrench)
- leather work gloves
- appropriate health and safety gear
- 5-gallon pail
- plastic sheeting
- shipping containers
- packing materials
- bolt cutters
- Ziploc plastic bags
- containers for evacuation of liquids
- decontamination solutions
- tap water
- non-phosphate soap
- several brushes

Table 2: Advantages and Disadvantages of Various Groundwater Sampling Devices

Device	Advantages	Disadvantages
Bailer	• The only practical limitations are size and materials • No power source needed • Portable • Inexpensive; it can be dedicated and hung in a well reducing the chances of cross-contamination • Minimal outgassing of volatile organics while sample is in bailer • Readily available • Removes stagnant water first • Rapid, simple method for removing small volumes of purge water	• Time consuming, especially for large wells • Transfer of sample may cause aeration
Submersible Pump	• Portable; can be used on an unlimited number of wells • Relatively high pumping rate (dependent on depth and size of pump) • Generally very reliable; does not require priming	• Potential for effects on analysis of trace organics • Heavy and cumbersome, particularly in deeper wells • Expensive • Power source needed • Susceptible to damage from silt or sediment • Impractical in low yielding or shallow wells
Non-Gas Contact Bladder Pump	• Maintains integrity of sample • Easy to use	• Difficult to clean although dedicated tubing and bladder may be used • Only useful to approximately 100 feet in depth • Supply of gas for operation (bottled gas and/or compressor) is difficult to obtain and is cumbersome
Suction Pump	• Portable, inexpensive, and readily available	• Only useful to approximately 25 feet or less in depth • Vacuum can cause loss of dissolved gases and volatile organics • Pump must be primed and vacuum is often difficult to maintain • May cause pH modification
Inertia Pump	• Portable, inexpensive, and readily available • Rapid method for purging relatively shallow wells	• Only useful to approximately 70 feet or less in depth • May be time consuming to use • Labor intensive • WaTerra pump is only effective in 2-inch diameter wells

- pails or tubs
- aluminum foil
- garden sprayer
- preservatives
- distilled or deionized water

2.5.2 Bailer

- clean, decontaminated bailer(s) of appropriate size and construction material
- nylon line, enough to dedicate to each well
- Teflon-coated bailer wire
- sharp knife
- aluminum foil (to wrap clean bailers)
- 5-gallon bucket

2.5.3 Submersible Pump

- pump(s)
- generator (110, 120, or 240 volt) or 12-volt battery if inaccessible to field vehicle
- 1-inch black PVC coil pipe -- enough to dedicate to each well
- hose clamps
- safety cable
- tool box supplement
  - pipe wrenches, 2
  - wire strippers
  - electrical tape
  - heat shrink
  - hose connectors
  - Teflon tape
- winch or pulley
- gasoline for generator
- flow meter with gate valve
- 1-inch nipples and various plumbing (i.e., pipe connectors)

2.5.4 Non-Gas Contact Bladder Pump

- non-gas contact bladder pump
- compressor or nitrogen gas tank
- batteries and charger
- Teflon tubing -- enough to dedicate to each well
- Swagelock fitting
- toolbox supplements -- same as submersible pump

2.5.5 Suction Pump

- pump
- black coil tubing -- enough to dedicate to each well
- gasoline -- if required
- toolbox
- plumbing fittings
- flow meter with gate valve

2.5.6 Inertia Pump

- pump assembly (WaTerra pump, piston pump)
- 5-gallon bucket

2.6 REAGENTS

Reagents will be utilized for preservation of samples and for decontamination of sampling equipment. The preservation required is specified by the analysis to be performed. Decontamination solutions are specified in ERT SOP #2006, Sampling Equipment Decontamination.

2.7 PROCEDURES

2.7.1 Preparation

1. Determine the extent of the sampling effort, the sampling methods to be employed, and which equipment and supplies are needed.

2. Obtain necessary sampling and monitoring equipment.

3. Decontaminate or preclean equipment, and ensure that it is in working order.

4. Prepare scheduling and coordinate with staff, clients, and regulatory agency, if appropriate.

5. Perform a general site survey prior to site entry in accordance with the site-specific health and safety plan.

6. Identify and mark all sampling locations.

2.7.2 Field Preparation

1. Start at the least contaminated well, if known.

2. Lay plastic sheeting around the well to minimize likelihood of contamination of equipment from soil adjacent to the well.

3. Remove locking well cap, note location, time of day, and date in field notebook or an appropriate log form.

4. Remove well casing cap.

5. Screen headspace of well with an appropriate monitoring instrument to determine the presence of volatile organic compounds and record in site logbook.

6. Lower water level measuring device or equivalent (i.e., permanently installed transducers or airline) into well until water surface is encountered.

7. Measure distance from water surface to reference measuring point on well casing or protective barrier post and record in site logbook. Alternatively, if there is no reference point, note that water level measurement is from top of steel casing, top of PVC riser pipe, from ground surface, or some other position on the well head.

8. Measure total depth of well (do this at least twice to confirm measurement) and record in site logbook or on log form.

9. Calculate the volume of water in the well and the volume to be purged using the calculations in Section 2.8.

10. Select the appropriate purging and sampling equipment.

2.7.3 Evacuation of Static Water (Purging)

The amount of flushing a well receives prior to sample collection depends on the intent of the monitoring program as well as the hydrogeologic conditions. Programs where overall quality determination of water resources are involved may require long pumping periods to obtain a sample that is representative of a large volume of that aquifer. The pumped volume can be determined prior to sampling so that the sample is a composite of known volume of the aquifer, or the well can be pumped until the stabilization of parameters such as temperature, electrical conductance, or pH has occurred.

However, monitoring for defining a contaminant plume requires a representative sample of a small volume of the aquifer. These circumstances require that the well be pumped enough to remove the stagnant water but not enough to induce flow from other areas. Generally, three well volumes are considered effective, or calculations can be made to determine, on the basis of the aquifer parameters and well dimensions, the appropriate volume to remove prior to sampling.

During purging, water level measurements may be taken regularly at 15- to 30-second intervals. This data may be used to compute aquifer transmissivity and other hydraulic characteristics.

The following well evacuation devices are most commonly used. Other evacuation devices are available, but have been omitted in this discussion due to their limited use.

Bailer

Bailers are the simplest purging device used and have many advantages. They generally consist of a rigid length of tube, usually with a ball check-valve at the bottom. A line is used to lower the bailer into the well and retrieve a volume of water. The three most common types of bailer are PVC, Teflon, and stainless steel.

This manual method of purging is best suited to shallow or narrow diameter wells. For deep, larger diameter wells which require evacuation of large volumes of water, other mechanical devices may be more appropriate.

Bailing equipment includes a clean decontaminated bailer, Teflon or nylon line, a sharp knife, and plastic sheeting.

1. Determine the volume of water to be purged as described in Section 2.7.2, Field Preparation.

2. Lay plastic sheeting around the well to prevent contamination of the bailer line with foreign materials.

3. Attach the line to the bailer and lower until the bailer is completely submerged.

4. Pull bailer out ensuring that the line either falls onto a clean area of plastic sheeting or never touches the ground.

5. Empty the bailer into a pail until full to determine the number of bails necessary to achieve the required purge volume.

6. Thereafter, pour the water into a container and dispose of purge waters as specified in the site-specific project plan.

Submersible Pump

Submersible pumps are generally constructed of plastic, rubber, and metal parts which may affect the analysis of samples for certain trace organics and inorganics. As a consequence, submersible pumps may not be appropriate for investigations requiring analyses of samples for trace contaminants. However, they are still useful for pre-sample purging. However, the pump must have a check valve to prevent water in the pump and the pipe from rushing back into the well.

Submersible pumps generally use one of two types of power supplies, either electric or compressed gas. Electric pumps can be powered by a 12-volt DC rechargeable battery, or a 110- or 220-volt AC power supply. Those units powered by compressed gas normally use a small electric compressor which also needs 12-volt DC or 110-volt AC power. They may also utilize compressed gas from bottles. Pumps differ according to the depth and diameter of the monitoring wells.

1. Determine the volume of water to be purged as described in section 2.7.2, Field Preparation.

2. Lay plastic sheeting around the well to prevent contamination of pumps, hoses or lines with foreign materials.

3. Assemble pump, hoses and safety cable, and lower the pump into the well. Make sure the pump is deep enough so that purging does not evacuate all the water. (Running the pump without water may cause damage.)

4. Attach flow meter to the outlet hose to measure the volume of water purged.

5. Attach power supply, and purge well until specified volume of water has been evacuated (or until field parameters, such as temperature, pH, conductivity, etc. have stabilized). Do not allow the pump to run dry. If the pumping rate exceeds the well recharge rate, lower the pump further into the well, and continue pumping.

6. Collect and dispose of purge waters as specified in the site-specific project plan.

Non-Contact Gas Bladder Pump

For this procedure, an all stainless-steel and Teflon Middleburg-squeeze bladder pump (e.g., IEA, TIMCO, Well Wizard, Geoguard, and others) is used to provide the least amount of material interference to the sample (Barcelona, 1985). Water comes into contact with the inside of the bladder (Teflon) and the sample tubing, also Teflon, that may be dedicated to each well. Some wells may have permanently installed bladder pumps (i.e., Well Wizard, Geoguard), that will be used to sample for all parameters.

1. Assemble Teflon tubing, pump and charged control box.

2. Use the same procedure for purging with a bladder pump as for a submersible pump.

3. Be sure to adjust flow rate to prevent violent jolting of the hose as sample is drawn in.

Suction Pump

There are many different types of suction pumps. They include: centrifugal, peristaltic and diaphragm. Diaphragm pumps can be used for well evacuation at a fast pumping rate and sampling at a low pumping rate. The peristaltic pump is a low-volume pump that uses rollers to squeeze the flexible tubing, thereby creating suction. This tubing can be dedicated to a well to prevent cross-contamination. Peristaltic pumps, however, require a power source.

1. Assemble the pump, tubing, and power source if necessary.

2. To purge with a suction pump, follow the exact procedures outlined for the submersible pump.

Inertia Pump

Inertia pumps, such as the WaTerra pump and piston pump, are manually operated. They are appropriate to use when wells are too deep to bail by hand, but are not inaccessible enough to warrant an automatic (submersible, etc.) pump. These

pumps are made of plastic and may be either decontaminated or discarded, after use.

1. Determine the volume of water to be purged as described in Section 2.7.2, Field Preparation.

2. Lay plastic sheeting around the well to prevent contamination of pumps or hoses with foreign materials.

3. Assemble pump, and lower to the appropriate depth in the well.

4. Begin pumping manually, discharging water into a 5-gallon bucket (or other graduated vessel). Purge until specified volume of water has been evacuated (or until field parameters such as temperature, pH, conductivity, etc. have stabilized).

5. Collect and dispose of purge waters as specified in the site-specific project plan.

2.7.4 Sampling

Sample withdrawal methods require the use of pumps, compressed air, bailers, and samplers. Ideally, purging and sample withdrawal equipment should be completely inert, economical to use, easily cleaned, sterilized, reusable, able to operate at remote sites in the absence of power resources, and capable of delivering variable rates for sample collection.

There are several factors to take into consideration when choosing a sampling device. Care should be taken when reviewing the advantages or disadvantages of any one device. It may be appropriate to use a different device to sample than that which was used to purge. The most common example of this is the use of a submersible pump to purge and a bailer to sample.

Bailer

The positive-displacement volatile sampling bailer (by GPI) is perhaps the most appropriate for collection of water samples for volatile analysis. Other bailer types (messenger, bottom fill, etc.) are less desirable, but may be mandated by cost and site conditions. Generally, bailers can provide an acceptable sample, providing that sampling personnel use extra care in the collection process.

1. Surround the monitoring well with clean plastic sheeting.

2. Attach a line to the bailer. If a bailer was used for purging, the same bailer and line may be used for sampling.

3. Lower the bailer slowly and gently into the well, taking care not to shake the casing sides or to splash the bailer into the water. Stop lowering at a point adjacent to the screen.

4. Allow bailer to fill and then slowly and gently retrieve the bailer from the well, avoiding contact with the casing, so as not to knock flakes of rust or other foreign materials into the bailer.

5. Remove the cap from the sample container and place it on the plastic sheet or in a location where it will not become contaminated. See Section 2.7.7 for special considerations on VOA samples.

6. Begin pouring slowly from the bailer.

7. Filter and preserve samples as required by sampling plan.

8. Cap the sample container tightly and place pre-labeled sample container in a carrier.

9. Replace the well cap.

10. Log all samples in the site logbook and on field data sheets and label all samples.

11. Package samples and complete necessary paperwork.

12. Transport sample to decontamination zone to prepare it for transport to analytical laboratory.

Submersible Pump

Although it is recommended that samples not be collected with a submersible pump due to the reasons stated in Section 2.4, there are some situations where they may be used.

1. Allow the monitoring well to recharge after purging, keeping the pump just above the screened section.

2. Attach gate valve to hose (if not already fitted), and reduce flow of water to a manageable sampling rate.

3. Assemble the appropriate bottles.

4. If no gate valve is available, run the water down the side of a clean jar and fill the sample bottles from the jar.

5. Cap the sample container tightly and place pre-labeled sample container in a carrier.

6. Replace the well cap.

7. Log all samples in the site logbook and on the field data sheets and label all samples.

8. Package samples and complete necessary paperwork.

9. Transport sample to decontamination zone for preparation for transport to analytical laboratory.

10. Upon completion, remove pump and assembly and fully decontaminate prior to setting into the next sample well. Dedicate the tubing to the hole.

Non-Gas Contact Bladder Pump

The use of a non-gas contact positive displacement bladder pump is often mandated by the use of dedicated pumps installed in wells. These pumps are also suitable for shallow (less than 100 feet) wells. They are somewhat difficult to clean, but may be used with dedicated sample tubing to avoid cleaning. These pumps require a power supply and a compressed gas supply (or compressor). They may be operated at variable flow and pressure rates making them ideal for both purging and sampling.

Barcelona (1984) and Nielsen (1985) report that the non-gas contact positive displacement pumps cause the least amount of alteration in sample integrity as compared to other sample retrieval methods.

1. Allow well to recharge after purging.

2. Assemble the appropriate bottles.

3. Turn pump on, increase the cycle time and reduce the pressure to the minimum that will allow the sample to come to the surface.

4. Cap the sample container tightly and place pre-labeled sample container in a carrier.

5. Replace the well cap.

6. Log all samples in the site logbook and on field data sheets and label all samples.

7. Package samples and complete necessary paperwork.

8. Transport sample to decontamination zone for preparation for transport to analytical laboratory.

9. On completion, remove the tubing from the well and either replace the Teflon tubing and bladder with new dedicated tubing and bladder or rigorously decontaminate the existing materials.

10. Collect non-filtered samples directly from the outlet tubing into the sample bottle.

11. For filtered samples, connect the pump outlet tubing directly to the filter unit. The pump pressure should remain decreased so that the pressure build-up on the filter does not blow out the pump bladder or displace the filter. For the Geotech barrel filter, no actual connections are necessary so this is not a concern.

Suction Pump

In view of the limitations of suction pumps, they are not recommended for sampling purposes.

Inertia Pump

Inertia pumps may be used to collect samples. It is more common, however, to purge with these pumps and sample with a bailer.

1. Following well evacuation, allow the well to recharge.

2. Assemble the appropriate bottles.

3. Since these pumps are manually operated, the flow rate may be regulated by the sampler. The sample may be discharged from the pump outlet directly into the appropriate sample container.

4. Cap the sample container tightly and place pre-labeled sample container in a carrier.

5. Replace the well cap.

6. Log all samples in the site logbook and on field data sheets and label all samples.

7. Package samples and complete necessary paperwork.

8. Transport sample to decontamination zone for preparation for transport to analytical laboratory.

9. Upon completion, remove pump and decontaminate or discard, as appropriate.

2.7.5 Filtering

For samples that require filtering, such as samples which will be analyzed for total metals, the filter must be decontaminated prior to use and between uses. Filters work by two methods. A barrel filter such as the "Geotech" filter works with a bicycle pump, which is used to build up positive pressure in the chamber containing the sample. The sample is then forced through the filter paper (minimum size 0.45 μm) into a jar placed underneath. The barrel itself is filled manually from the bailer or directly via the hose of the sampling pump. The pressure must be maintained up to 30 psi by periodic pumping.

A vacuum type filter involves two chambers, the upper chamber contains the sample and a filter (minimum size 0.45 μm) divides the chambers. Using a hand pump or a Gilian type pump, air is withdrawn from the lower chamber, creating a vacuum and thus causing the sample to move through the filter into the lower chamber where it is drained into a sample jar, repeated pumping may be required to drain all the sample into the lower chamber. If preservation of the sample is necessary, this should be done after filtering.

2.7.6 Post Operation

After all samples are collected and preserved, the sampling equipment should be decontaminated prior to sampling another well. This will prevent cross-contamination of equipment and monitoring wells between locations.

1. Decontaminate all equipment.

2. Replace sampling equipment in storage containers.

3. Prepare and transport water samples to the laboratory. Check sample documentation and make sure samples are properly packed for shipment.

2.7.7 Special Considerations for VOA Sampling

The proper collection of a sample for volatile organics requires minimal disturbance of the sample to limit volatilization and therefore a loss of volatiles from the sample.

Sample retrieval systems suitable for the valid collection of volatile organic samples are: positive displacement bladder pumps, gear driven submersible pumps, syringe samplers and bailers (Barcelona, 1984; Nielsen, 1985). Field conditions and other constraints will limit the choice of appropriate systems. The focus of concern must be to provide a valid sample for analysis, one which has been subjected to the least amount of turbulence possible.

The following procedures should be followed:

1. Open the vial, set cap in a clean place, and collect the sample during the middle of the cycle. When collecting duplicates, collect both samples at the same time.

2. Fill the vial to just overflowing. Do not rinse the vial, nor excessively overfill it. There should be a convex meniscus on the top of the vial.

3. Check that the cap has not been contaminated (splashed) and carefully cap the vial. Place the cap directly over the top and screw down firmly. Do not overtighten and break the cap.

4. Invert the vial and tap gently. Observe vial for at least 10 seconds. If an air bubble appears, discard the sample and begin again. It is imperative that no entrapped air is in the sample vial.

5. Immediately place the vial in the protective foam sleeve and place into the cooler, oriented so that it is lying on its side, not straight up.

6. The holding time for VOAs is 7 days. Samples should be shipped or delivered to the laboratory daily so as not to exceed the holding time. Ensure that the samples remain at 4°C, but do not allow them to freeze.

2.8 CALCULATIONS

There are no calculations necessary to implement this procedure. However, if it is necessary to calculate the volume of the well, utilize the following equation:

$$\text{Well volume} = \pi r^2 h\ (cf) \quad \text{[Equation 1]}$$

where:

- π = pi
- r = radius of monitoring well (feet)
- h = height of the water column (feet) [This may be determined by subtracting the depth to water from the total depth of the well as measured from the same reference point.]
- cf = conversion factor (gal/ft^3) = 7.48 gal/ft^3 [In this equation, 7.48 gal/ft^3 is the necessary conversion factor.]

Monitoring wells are typically 2, 3, 4, or 6 inches in diameter. If you know the diameter of the monitoring well, there are a number of standard conversion factors which can be used to simplify the equation above.

The volume, in gallons per linear foot, for various standard monitoring well diameters can be calculated as follows:

$$v = \pi r^2\ (cf) \quad \text{[Equation 2]}$$

where:

- v = volume in gallons per linear foot
- π = pi
- r = radius of monitoring well (feet)
- cf = conversion factor (7.48 gal/ft^3)

For a 2-inch diameter well, the volume in gallons per linear foot can be calculated as follows:

$$v = \pi r^2\ (cf) \quad \text{[Equation 2]}$$
$$= 3.14\ (1/12\ ft)^2\ 7.48\ gal/ft^3$$
$$= 0.1632\ gal/ft$$

Remember that if you have a 2-inch diameter, well you must convert this to the radius in feet to be able to use the equation.

The volume in gallons per linear foot for the common size monitoring wells are as follows:

Well Diameter	v (volume in gal/ft.)
2 inches	0.1632
3 inches	0.3672
4 inches	0.6528
6 inches	1.4688

If you utilize the conversion factors above, Equation 1 should be modified as follows:

$$\text{Well volume} = (h)(v) \quad \text{[Equation 3]}$$

where:

- h = height of water column (feet)
- v = volume in gallons per linear foot as calculated from Equation 2

2.9 QUALITY ASSURANCE/ QUALITY CONTROL

There are no specific quality assurance activities which apply to the implementation of these procedures. However, the following general QA procedures apply:

- All data must be documented on field data sheets or within site logbooks.

- All instrumentation must be operated in accordance with operating instructions as supplied by the manufacturer, unless

5.0 WATER LEVEL MEASUREMENT: SOP #2151

5.1 SCOPE AND APPLICATION

The purpose of this Standard Operating Procedure (SOP) is to set guidelines for the determination of the depth to water in an open borehole, cased borehole, monitoring well or piezometer.

Generally, water level measurements from boreholes, piezometers, or monitoring wells are used to construct water table or potentiometric surface maps. Therefore, all water level measurements at a given site should be collected within a 24-hour period. Certain situations may necessitate that all water level measurements be taken within a shorter time interval. These situations may include:

- the magnitude of the observed changes between wells appears too large
- atmospheric pressure changes
- aquifers which are tidally influenced
- aquifers affected by river stage, impoundments, and/or unlined ditches
- aquifers stressed by intermittent pumping of production wells
- aquifers being actively recharged due to precipitation events

5.2 METHOD SUMMARY

A survey mark should be placed on the casing for use as a reference point for measurement. Many times the lip of the riser pipe is not flat. Another measuring reference should be located on the grout apron. The measuring point should be documented in the site logbook and on the groundwater level data form (see Appendix C).

Water levels in piezometers and monitoring wells should be allowed to stabilize for a minimum of 24 hours after well construction and development, prior to measurement. In low yield situations, recovery may take longer.

Working with decontaminated equipment, proceed from the least to the most contaminated wells. Open the well and monitor headspace with the appropriate monitoring instrument to determine the presence of volatile organic compounds. Lower the water level measurement device into the well until water surface or bottom of casing is encountered. Measure distance from water surface to the reference point on the well casing and record in the site logbook and/or groundwater level data form. Remove all downhole equipment, decontaminate as necessary, and replace well casing cap.

5.3 SAMPLE PRESERVATION, CONTAINERS, HANDLING AND STORAGE

This section is not applicable to this SOP.

5.4 INTERFERENCES AND POTENTIAL PROBLEMS

- The chalk used on steel tape may contaminate the well.
- Cascading water may obscure the water mark or cause it to be inaccurate.
- Many types of electric sounders use metal indicators at 5-foot intervals around a conducting wire. These intervals should be checked with a surveyor's tape to ensure accuracy.
- If there is oil present on the water, it can insulate the contacts of the probe on an electric sounder or give false readings due to thickness of the oil. Determining the thickness and density of the oil layer may be warranted, in order to determine the correct water level.
- Turbulence in the well and/or cascading water can make water level determination difficult with either an electric sounder or steel tape.

- An airline measures drawdown during pumping. It is only accurate to 0.5 foot unless it is calibrated for various "drawdowns".

5.5 EQUIPMENT/APPARATUS

There are a number of devices which can be used to measure water levels, such as steel tape or airlines. The device should be adequate to attain an accuracy of 0.01 feet.

The following equipment is needed to measure water levels:

- air monitoring equipment
- water level measurement device
- electronic water level indicator
- metal tape measure
- airline
- steel tape
- chalk
- ruler
- notebook
- paper towels
- decontamination solution and equipment
- groundwater level data forms

5.6 REAGENTS

No chemical reagents are used in this procedure, with the exception of decontamination solutions. Where decontamination of equipment is required, refer to ERT SOP #2006, Sampling Equipment Decontamination and the site-specific work plan.

5.7 PROCEDURES

5.7.1 Preparation

1. Determine the extent of the sampling effort, the sampling methods to be employed, and which equipment and supplies are needed.

2. Obtain necessary sampling and monitoring equipment.

3. Decontaminate or preclean equipment, and ensure that it is in working order.

4. Prepare scheduling and coordinate with staff, clients, and regulatory agency, if appropriate.

5. Perform a general site survey prior to site entry in accordance with the site-specific health and safety plan.

6. Identify and mark all sampling locations.

5.7.2 Procedures

1. Make sure water level measuring equipment is in good operating condition.

2. If possible and where applicable, start at those wells that are least contaminated and proceed to those wells that are most contaminated.

3. Clean all equipment entering the well by the following decontamination procedure:

   - Triple rinse equipment with deionized water.

   - Wash equipment with an Alconox solution followed by a deionized water rinse.

   - Rinse with an approved solvent (e.g., methanol, isopropyl alcohol, acetone) as per the work plan, if organic contamination is suspected.

   - Place equipment on clean surface such as a Teflon or polyethylene sheet.

4. Remove locking well cap, note location, time of day, and date in site notebook or an appropriate groundwater level data form.

5. Remove well casing cap.

6. If required by site-specific condition, monitor headspace of well with PID or FID to determine presence of volatile organic compounds and record in site logbook.

7. Lower electric water level measuring device or equivalent (i.e., permanently installed tranducers or airline) into the well until water surface is encountered.

8. Measure the distance from the water surface to the reference measuring point on the well casing or protective barrier post and record in the field logbook. In addition, note that the

water level measurement was from the top of the steel casing, top of the PVC riser pipe, from the ground surface, or from some other position on the well head.

9. The groundwater level data form in Appendix C should be completed as follows:

   - site name
   - logger name: person taking field notes
   - date: the date when the water levels are being measured
   - location: monitor well number and physical location
   - time: the military time at which the water level measurement was recorded
   - depth to water: the water level measurement in feet, or in tenths or hundreds of feet, depending on the equipment used
   - comments: any information the field personnel feels to be applicable
   - measuring point: marked measuring point on PVC riser pipe, protective steel casing or concrete pad surrounding well casing from which all water level measurements for individual wells should be measured. This provides consistency in future water level measurements.

10. Measure total depth of well (at least twice to confirm measurement) and record in site notebook or on log form.

11. Remove all downhole equipment, replace well casing cap and lock steel caps.

12. Rinse all downhole equipment and store for transport to next well.

13. Note any physical changes such as erosion or cracks in protective concrete pad or variation in total depth of well in field notebook and on field data sheets.

14. Decontaminate all equipment as outlined in Step 3 above.

5.8 CALCULATIONS

To determine groundwater elevation above mean sea level, use the following equation:

$$Ew = E-D$$

where:

- Ew = Elevation of water above mean sea level
- E = Elevation above sea level at point of measurement
- D = Depth to water

5.9 QUALITY ASSURANCE/ QUALITY CONTROL

The following general quality assurance procedures apply:

- All data must be documented on standard chain of custody forms, field data sheets or within personal/site logbooks.
- All instrumentation must be operated in accordance with operating instructions as supplied by the manufacturer, unless otherwise specified in the work plan. Equipment checkout and calibration activities must occur prior to sampling/operation, and they must be documented.
- Each well should be tested at least twice in order to compare results.

5.10 DATA VALIDATION

This section is not applicable to this SOP.

5.11 HEALTH AND SAFETY

When working with potentially hazardous materials, follow U.S. EPA, OSHA, and specific health and safety procedures.

EPA/540/P-91/008
OSWER Directive 9360.4-07
January 1991

COMPENDIUM OF ERT WASTE SAMPLING PROCEDURES

Sampling Equipment Decontamination

Drum Sampling

Tank Sampling

Chip, Wipe, and Sweep Sampling

Waste Pile Sampling

Interim Final

Environmental Response Team
Emergency Response Division

Office of Emergency and Remedial Response
U.S. Environmental Protection Agency
Washington, DC 20460

2.0 DRUM SAMPLING: SOP #2009

2.1 SCOPE AND APPLICATION

The purpose of this Standard Operating Procedure (SOP) is to provide technical guidance on safe and cost-effective response actions at hazardous waste sites containing drums with unknown contents. Container contents are sampled and characterized for disposal, bulking, recycling, grouping, and/or classification purposes.

2.2 METHOD SUMMARY

Prior to sampling, drums must be inventoried, staged, and opened. An inventory entails recording visual qualities of each drum and any characteristics pertinent to the contents' classification. Staging involves the organization, and sometimes consolidation of drums which have similar wastes or characteristics. Opening of closed drums can be performed manually or remotely. Remote drum opening is recommended for worker safety. The most widely used method of sampling a drum involves the use of a glass thief. This method is quick, simple, relatively inexpensive, and requires no decontamination.

2.3 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

Samples collected from drums are considered waste samples. No preservatives should be added since there is a potential reaction of the sample with the preservative. Samples should, however, be cooled to 4°C and protected from sunlight in order to minimize any potential reaction due to the light sensitivity of the sample.

Sample bottles for collection of waste liquids, sludges, or solids are typically wide-mouth amber jars with Teflon-lined screw caps. Actual volume required for analysis should be determined in conjunction with the laboratory performing the analysis.

Follow these waste sample handling procedures:

1. Place sample container in two Ziploc plastic bags.
2. Place each bagged container in a 1-gallon covered can containing absorbent packing material. Place the lid on the can.
3. Mark the sample identification number on the outside of the can.
4. Place the marked cans in a cooler, and fill remaining space with absorbent packing material.
5. Fill out chain of custody form for each cooler, place in plastic, and affix to inside lid of cooler.
6. Secure and custody seal the lid of cooler.
7. Arrange for the appropriate transportation mode consistent with the type of hazardous waste involved.

2.4 INTERFERENCES AND POTENTIAL PROBLEMS

The practice of tapping drums to determine their contents is neither safe nor effective and should not be used if the drums are visually overpressurized or if shock-sensitive materials are suspected. A laser thermometer may be used instead.

Drums that have been overpressurized, to the extent that the head is swollen several inches above the level of the chime, should not be moved. A number of devices have been developed for venting critically swollen drums. One method that has proven to be effective is a tube and spear device. A light aluminum tube (3 meters long) is positioned at the vapor space of the drum. A rigid, hooking device attached to the tube goes over the chime and holds the tube securely in place. The spear is inserted in the tube and positioned against the drum wall. A sharp blow on the end of the spear drives the sharpened tip through the drum and the gas vents along the grooves. The venting should be done from behind a wall or barricade. This device can be cheaply and easily designed and constructed where needed. Once the pressure has been relieved, the bung can be removed and the drum sampled.

2.5 EQUIPMENT/APPARATUS

The following are standard materials and equipment required for sampling:

- personal protection equipment
- wide-mouth glass jars with Teflon cap liner, approximately 500 mL volume
- uniquely numbered sample identification labels with corresponding data sheets
- 1-gallon covered cans half-filled with absorbent (vermiculite)
- chain of custody forms
- decontamination materials
- glass thief tubes or Composite Liquid Waste Samplers (COLIWASA)
- laser thermometer
- drum opening devices

Drum opening devices include the following:

2.5.1 Bung Wrench

A common method for opening drums manually is using a universal bung wrench. These wrenches have fittings made to remove nearly all commonly encountered bungs. They are usually constructed of cast iron, brass, or a bronze-beryllium, non-sparking alloy formulated to reduce the likelihood of sparks. The use of a non-sparking bung wrench does not completely eliminate the possibility of a spark being produced. (See Figure 1, Appendix B.)

2.5.2 Drum Deheader

When a bung is not removable with a bung wrench, a drum can be opened manually by using a drum deheader. This tool is constructed of forged steel with an alloy steel blade and is designed to cut the lid of a drum off or part way off by means of a scissors-like cutting action. A limitation of this device is that it can be attached only to closed head drums. Drums with removable heads must be opened by other means. (See Figure 2, Appendix B.)

2.5.3 Hand Pick, Pickaxe, and Hand Spike

These tools are usually constructed of brass or a non-sparking alloy with a sharpened point that can penetrate the drum lid or head when the tool is swung. The hand picks or pickaxes that are most commonly used are commercially available; whereas the spikes are generally uniquely fabricated 4-foot long poles with a pointed end. (See Figure 3, Appendix B.)

2.5.4 Backhoe Spike

The most common means used to open drums remotely for sampling is the use of a metal spike attached or welded to a backhoe bucket. In addition to being very efficient, this method can greatly reduce the likelihood of personal exposure. (See Figure 4, Appendix B.)

2.5.5 Hydraulic Drum Opener

Another remote method for opening drums is with remotely operated hydraulic devices. One such device uses hydraulic pressure to pierce through the wall of a drum. It consists of a manually operated pump which pressurizes soil through a length of hydraulic line. (See Figure 5, Appendix B.)

2.5.6 Pneumatic Devices

A pneumatic bung remover consists of a compressed air supply that is controlled by a heavy-duty, two-stage regulator. A high-pressure air line of desired length delivers compressed air to a pneumatic drill, which is adapted to turn a bung fitting selected to fit the bung to be removed. An adjustable bracketing system has been designed to position and align the pneumatic drill over the bung. This bracketing system must be attached to the drum before the drill can be operated. Once the bung has been loosened, the bracketing system must be removed before the drum can be sampled. This remote bung opener does not permit the slow venting of the container, and therefore appropriate precautions must be taken. It also requires the container to be upright and relatively level. Bungs that are rusted shut cannot be removed with this device. (See Figure 6, Appendix B.)

2.6 REAGENTS

Reagents are not typically required for preserving drum samples. However, reagents are used for decontaminating sampling equipment. Decontamination solutions are specified in ERT SOP #2006, Sampling Equipment Decontamination.

2.7 PROCEDURES

2.7.1 Preparation

1. Determine the extent of the sampling effort, the sampling methods to be employed, and which equipment and supplies are needed.

2. Obtain necessary sampling and monitoring equipment.

3. Decontaminate or preclean equipment, and ensure that it is in working order.

4. Prepare scheduling and coordinate with staff, clients, and regulatory agency, if appropriate.

5. Perform a general site survey prior to site entry in accordance with the site-specific health and safety plan.

6. Use stakes, flagging, or buoys to identify and mark all sampling locations. If required, the proposed locations may be adjusted based on site access, property boundaries, and surface obstructions.

2.7.2 Drum Inspection

Appropriate procedures for handling drums depend on the contents. Thus, prior to any handling, drums should be visually inspected to gain as much information as possible about their contents. Those in charge of inspections should be on the look-out for:

- drum condition, corrosion, rust, and leaking contents
- symbols, words, or other markings on the drum indicating hazards (i.e., explosive, radioactive, toxic, flammable)
- signs that the drum is under pressure
- shock sensitivity

Monitor around the drums with radiation instruments, organic vapor monitors (OVA) and combustible gas indicators (CGI).

Classify the drums into categories, for instance:

- radioactive
- leaking/deteriorating
- bulging
- drums containing lab packs
- explosive/shock sensitive

All personnel should assume that unmarked drums contain hazardous materials until their contents have been categorized, and that labels on drums may not accurately describe their contents.

If it is presumed that there are buried drums on-site, geophysical investigation techniques such as magnetometry, ground penetrating radar, and metal detection can be employed in an attempt to determine depth and location of the drums. See ERT SOP #2159, General Surface Geophysics.

2.7.3 Drum Staging

Prior to sampling, the drums should be staged to allow easy access. Ideally, the staging area should be located just far enough from the drum opening area to prevent a chain reaction if one drum should explode or catch fire when opened.

While staging, physically separate the drums into the following categories: those containing liquids, those containing solids, lab packs, or gas cylinders, and those which are empty. This is done because the strategy for sampling and handling drums/containers in each of these categories will be different. This may be achieved by:

- Visual inspection of the drum and its labels, codes, etc. Solids and sludges are typically disposed of in open-top drums. Closed-head drums with a bung opening generally contain liquid.

- Visual inspection of the contents of the drum during sampling followed by restaging, if needed.

Once a drum has been excavated and any immediate hazard has been eliminated by overpacking or transferring the drum's contents, affix a numbered tag to the drum and transfer it to a staging area. Color-coded tags, labels, or bands should be used to mark similar waste types. Record a description of each drum, its condition, any unusual markings, and the location where it was buried or stored, on a drum data sheet (Appendix A). This data sheet becomes the principal

recordkeeping tool for tracking the drum onsite.

Where there is good reason to suspect that some drums contain radioactive, explosive, and shock-sensitive materials, these drums should be staged in a separate, isolated area. Placement of explosives and shock-sensitive materials in diked and fenced areas will minimize the hazard and the adverse effects of any premature detonation of explosives.

Where space allows, the drum opening area should be physically separated from the drum removal and drum staging operations. Drums are moved from the staging area to the drum opening area one at a time using forklift trucks equipped with drum grabbers or a barrel grappler. In a large-scale drum handling operation, drums may be conveyed to the drum opening area using a roller conveyor.

2.7.4 Drum Opening

There are three basic techniques available for opening drums at hazardous waste sites:

- Manual opening with non-sparking bung wrenches,
- Drum deheading, and
- Remote drum puncturing or bung removal.

The choice of drum opening techniques and accessories depends on the number of drums to be opened, their waste contents, and physical condition. Remote drum opening equipment should always be considered in order to protect worker safety. Under OSHA 1910.120, manual drum opening with bung wrenches or deheaders should be performed only with structurally sound drums having contents that are known to be (1) not shock sensitive, (2) non-reactive, (3) non-explosive, and (4) non-flammable.

Manual Drum Opening with a Bung Wrench

Manual drum opening with bung wrenches (Figure 1, Appendix B) should not be performed unless the drums are structurally sound (no evidence of bulging or deformation) and their contents are known to be non-explosive. If opening the drum with bung wrenches is deemed reasonably cost-effective and safe, then follow these procedures to minimize the hazard:

1. Fully outfit field personnel with protective gear.
2. Position drum upright with the bung up, or, for drums with bungs on the side, lay the drum on its side with the bung plug up.
3. Wrench the bung with a slow, steady pulling motion across the drum. If the length of the bung wrench handle provides inadequate leverage for unscrewing the plug, attach a "cheater bar" to the handle to improve leverage.

Manual Drum Opening with a Drum Deheader

Drums are opened with a drum deheader (Figure 2, Appendix B) by first positioning the cutting edge just inside the top chime and then tightening the adjustment screw so that the deheader is held against the side of the drum. Moving the handle of the deheader up and down while sliding the deheader along the chime will cut off the entire top. If the top chime of a drum has been damaged or badly dented, it may not be possible to cut off the entire top. Since there is always the possibility that a drum may be under pressure, make the initial cut very slowly to allow for the gradual release of any built-up pressure. A safer technique would be to use a remote method to puncture the drum prior to using the deheader.

Self-propelled drum openers which are either electrically or pneumatically driven can be used for quicker and more efficient deheading.

Manual Drum Opening with a Hand Pick, Pickaxe, or Spike

When a drum must be opened and neither a bung wrench nor a drum deheader is suitable, the drum can be opened for sampling by using a hand pick, pickaxe, or spike (Figure 3, Appendix B). Often the drum lid or head must be hit with a great deal of force in order to penetrate it. The potential for splash or spraying is greater than with other opening methods and, therefore, this method of drum opening is not recommended, particularly when opening drums containing liquids. Some spikes used have been modified by the addition of a circular splash plate near the penetrating end. This plate acts as a shield and reduces the amount of splash in the direction of the person using the spike. Even with this shield, good splash gear is essential.

Since drums cannot be opened slowly with these tools, spray from drums is common requiring appropriate safety measures. Decontaminate the pick or spike after each drum is opened to avoid cross-contamination and/or adverse chemical reaction from incompatible materials.

Remote Drum Opening with a Backhoe Spike

Remotely operated drum opening tools are the safest available means of drum opening. Remote drum opening is slow, but is much safer compared to manual methods of opening.

Drums should be "staged" or placed in rows with adequate aisle space to allow ease in backhoe maneuvering. Once staged, the drums can be quickly opened by punching a hole in the drum head or lid with the spike.

The spike (Figure 4, Appendix B) should be decontaminated after each drum is opened to prevent cross-contamination. Even though some splash or spray may occur when this method is used, the operator of the backhoe can be protected by mounting a large shatter-resistant shield in front of the operator's cage. This, combined with the required level of personal protection gear, should be sufficient to protect the operator. Additional respiratory protection can be afforded by providing the operator with an on-board airline system.

Remote Drum Opening with Hydraulic Devices

A piercing device with a metal point is attached to the end of a hydraulic line and is pushed into the drum by hydraulic pressure (Figure 5, Appendix B). The piercing device can be attached so that the sampling hole can be made on either the side or the head of the drum. Some of the metal piercers are hollow or tube-like so that they can be left in place if desired and serve as a permanent tap or sampling port. The piercer is designed to establish a tight seal after penetrating the container.

Remote Drum Opening with Pneumatic Devices

Pneumatically-operated devices utilizing compressed air have been designed to remove drum bungs remotely (Figure 6, Appendix B).

2.7.5 Drum Sampling

After the drum has been opened, monitor headspace gases using an explosimeter and organic vapor analyzer. In most cases it is impossible to observe the contents of these sealed or partially sealed vessels. Since some layering or stratification is likely in any solution left undisturbed over time, take a sample that represents the entire depth of the vessel.

When sampling a previously sealed vessel, check for the presence of a bottom sludge. This is easily accomplished by measuring the depth to the apparent bottom, then comparing it to the known interior depth.

Glass Thief Sampler

The most widely used implement for sampling is a glass tube commonly referred to as a glass thief (Figure 7, Appendix B). This tool is simple, cost effective, quick, and collects a sample without having to decontaminate. Glass thieves are typically 6mm to 16mm I.D. and 48 inches long.

Procedures for using a glass thief are as follows:

1. Remove cover from sample container.
2. Insert glass tubing almost to the bottom of the drum or until a solid layer is encountered. About one foot of tubing should extend above the drum.
3. Allow the waste in the drum to reach its natural level in the tube.
4. Cap the top of the sampling tube with a tapered stopper or thumb, ensuring liquid does not come into contact with stopper.
5. Carefully remove the capped tube from the drum and insert the uncapped end in the sample container.
6. Release stopper and allow the glass thief to drain until the container is approximately 2/3 full.
7. Remove tube from the sample container, break it into pieces and place the pieces in the drum.

8. Cap the sample container tightly and place prelabeled sample container in a carrier.

9. Replace the bung or place plastic over the drum.

10. Log all samples in the site logbook and on field data sheets.

11. Package samples and complete necessary paperwork.

12. Transport sample to decontamination zone to prepare it for transport to the analytical laboratory.

In many instances a drum containing waste material will have a sludge layer on the bottom. Slow insertion of the sample tube down into this layer and then a gradual withdrawal will allow the sludge to act as a bottom plug to maintain the fluid in the tube. The plug can be gently removed and placed into the sample container by the use of a stainless steel lab spoon.

It should be noted that in some instances disposal of the tube by breaking it into the drum may interfere with eventual plans for the removal of its contents. This practice should be cleared with the project officer or other disposal techniques evaluated.

COLIWASA Sampler

Some equipment is designed to collect a sample from the full depth of a drum and maintain it in the transfer tube until delivery to the sample bottle. These designs include primarily the Composite Liquid Waste Sampler (COLIWASA) and modifications thereof. The COLIWASA (Figure 8, Appendix B) is a much cited sampler designed to permit representative sampling of multiphase wastes from drums and other containerized wastes. One configuration consists of a 152 cm by 4 cm I.D. section of tubing with a neoprene stopper at one end attached by a rod running the length of the tube to a locking mechanism at the other end.

Manipulation of the locking mechanism opens and closes the sampler by raising and lowering the neoprene stopper. One model of the COLIWASA is shown in Appendix B; however, the design can be modified and/or adapted somewhat to meet the needs of the sampler.

The major drawbacks associated with using a COLIWASA concern decontamination and costs. The sampler is difficult, if not impossible to decontaminate in the field and its high cost in relation to alternative procedures (glass tubes) make it an impractical throwaway item. It still has applications, however, especially in instances where a true representation of a multiphase waste is absolutely necessary.

Follow these procedures for using the COLIWASA:

1. Put the sampler in the open position by placing the stopper rod handle in the T-position and pushing the rod down until the handle sits against the sampler's locking block.

2. Slowly lower the sampler into the liquid waste. Lower the sampler at a rate that permits the levels of the liquid inside and outside the sampler tube to be about the same. If the level of the liquid in the sample tube is lower than that outside the sampler, the sampling rate is too fast and will result in a non-representative sample.

3. When the sampler stopper hits the bottom of the waste container, push the sampler tube downward against the stopper to close the sampler. Lock the sampler in the closed position by turning the T-handle until it is upright and one end rests tightly on the locking block.

4. Slowly withdraw the sample from the waste container with one hand while wiping the sampler tube with a disposable cloth or rag with the other hand.

5. Carefully discharge the sample into a suitable sample container by slowly pulling the lower end of the T-handle away from the locking block while the lower end of the sampler is positioned in a sample container.

6. Cap the sample container tightly and place prelabeled sample container in a carrier.

7. Replace the bung or place plastic over the drum.

8. Log all samples in the site logbook and on field data sheets.

3.0 TANK SAMPLING: SOP #2010

3.1 SCOPE AND APPLICATION

The purpose of this Standard Operating Procedure (SOP) is to provide protocols for sampling tanks and other confined spaces from outside the vessel.

3.2 METHOD SUMMARY

The safe collection of a representative sample should be the criterion for selecting sample locations. A representative sample can be collected using techniques or equipment that are designed for obtaining liquids or sludges from various depths. The structure and characteristics of storage tanks present problems with collection of samples from more than one location; therefore, the selection of sampling devices is an important consideration.

Depending on the type of vessel and characteristics of the material to be sampled, one can choose a bailer, glass thief, bacon bomb sampler, sludge judge, COLIWASA, or subsurface grab sampler to collect the sample. For depths of less than 5-feet, a bailer, COLIWASA, or sludge judge can be used. A sludge judge, subsurface grab sampler, bailer, or bacon bomb sampler can be used for depths greater than 5-feet. A sludge judge or bacon bomb can be used to determine if the tank consists of various strata.

All sample locations should be surveyed for air quality prior to sampling. At no time should sampling continue with an LEL reading greater than 25%.

All personnel involved in tank sampling should be advised as to the hazards associated with working in unfavorable conditions.

3.3 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

Samples collected from tanks are considered waste samples and, as such, addition of preservatives is not required due to the potential reaction of the sample with the preservative. Samples should, however, be cooled to 4°C and protected from sunlight in order to minimize any potential reaction due to the light sensitivity of the sample.

Sample bottles for collection of waste liquids, sludges, or solids are typically wide-mouth amber jars with Teflon-lined screw caps. Actual volume required for analysis should be determined in conjunction with the laboratory performing the analysis.

Waste sample handling procedures should be as follows:

1. Place sample container in two Ziploc plastic bags.
2. Place each bagged container in a 1-gallon covered can containing absorbent packing material. Place the lid on the can.
3. Mark the sample identification number on the outside of the can.
4. Place the marked cans in a cooler, and fill remaining space with absorbent packing material.
5. Fill out a chain of custody form for each cooler, place it in plastic, and affix it to the inside lid of the cooler.
6. Secure and custody seal the lid of cooler.
7. Arrange for the transportation appropriate for the type of hazardous waste involved.

3.4 INTERFERENCES AND POTENTIAL PROBLEMS

Sampling a storage tank requires a great deal of manual dexterity, often requiring the sampler to climb to the top of the tank upon a narrow vertical or spiral stairway or ladder while wearing protective clothing and carrying sampling equipment.

Before climbing onto the vessel, perform a structural survey of the tank to ensure the sampler's

safety and accessibility prior to initiating field activities.

As in all opening of containers, take extreme caution to avoid ignition or combustion of volatile contents. All tools used must be constructed of a non-sparking material and electronic instruments must be intrinsically safe.

All sample locations should be surveyed for air quality prior to sampling. At no time should sampling continue with an LEL reading greater than 25%.

3.5 EQUIPMENT/APPARATUS

Storage tank materials include liquids, sludges, still bottoms, and solids of various structures. The type of sampling equipment chosen should be compatible with the waste. Samplers commonly used for tanks include: the bacon bomb sampler, the sludge judge, glass thief, bailer, COLIWASA, and subsurface grab sampler.

- sampling plan
- safety equipment
- tape measure
- weighted tape line or equivalent
- camera/film
- stainless steel bucket or bowl
- sample containers
- Ziploc plastic bags
- logbook
- labels
- field data sheets
- chain of custody forms
- flashlight (explosion proof)
- coolers
- ice
- decontamination supplies
- bacon bomb sampler
- sludge judge
- glass thief
- bailer
- COLIWASA
- subsurface grab sampler
- water/oil level indicator
- OVA (organic vapor analyzer or equivalent)
- explosimeter/oxygen meter
- high volume blower

3.6 REAGENTS

Reagents are not typically required for the preservation of waste samples. However, reagents will be utilized for decontamination of equipment. Decontamination solutions required are specified in ERT SOP #2006, Sampling Equipment Decontamination.

3.7 PROCEDURES

3.7.1 Preparation

1. Determine the extent of the sampling effort, the sampling methods to be employed, and which equipment and supplies are needed.
2. Obtain necessary sampling and monitoring equipment.
3. Decontaminate or preclean equipment, and ensure that it is in working order.
4. Prepare scheduling and coordinate with staff, clients, and regulatory agency, if appropriate.
5. Perform a general site survey prior to site entry in accordance with the site-specific health and safety plan.
6. Identify and mark all sampling locations.

3.7.2 Preliminary Inspection

1. Inspect the external structural characteristics of each tank and record in the site logbook. Potential sampling points should be evaluated for safety, accessibility, and sample quality.
2. Prior to opening a tank for internal inspection, the tank sampling team should:
   - Review safety procedures and emergency contingency plans with the Safety Officer,
   - Ensure that the tank is properly grounded,
   - Remove all sources of ignition from the immediate area.
3. Each tank should be mounted using appropriate means. Remove manway covers using non-sparking tools.

4. Collect air quality measurements for each potential sample location using an explosimeter/oxygen meter for a lower explosive limit (LEL/O_2) reading and an OVA/HNU for an organic vapor concentration. Both readings should be taken from the tank headspace, above the sampling port, and in the breathing zone.

5. Prior to sampling, the tank headspace should be cleared of any toxic or explosive vapor concentration using a high volume blower. No work should start if LEL readings exceed 25%. At 10% LEL, work can continue but with extreme caution.

3.7.3 Sampling Procedures

1. Determine the depth of any and all liquid-solid interface, and depth of sludge using a weighted tape measure, probe line, sludge judge, or equivalent.

2. Collect liquid samples from 1-foot below the surface, from mid-depth of liquid, and from 1-foot above the bottom sludge layer. This can be accomplished with a subsurface grab sampler or bacon bomb. For liquids less than 5-feet in depth, use a glass thief or COLIWASA to collect the sample.

   If sampling storage tanks, vacuum trucks, or process vessels, collect at least one sample from each compartment in the tank. Samples should always be collected through an opened hatch at the top of the tank. Valves near the bottom should not be used, because of their questionable or unknown integrity. If such a valve cannot be closed once opened, the entire tank contents may be lost to the ground surface. Also, individual strata cannot be sampled separately through a valve near the bottom.

3. Compare the three samples for visual phase differences. If phase differences appear, systematic iterative sampling should be performed. By halving the distance between two discrete sampling points, one can determine the depth of the phase change.

4. If another sampling port is available, sample as above to verify the phase information.

5. Measure the outside diameter of the tank and determine the volume of wastes using the depth measurements. (See Appendix C for calculations.)

6. Sludges can be collected using a bacon bomb sampler, glass thief, or sludge judge.

7. Record all information on the sample data sheet or site logbook. Label the container with the appropriate sample tag.

8. Decontaminate sampling equipment as per ERT SOP #2006, Sampling Equipment Decontamination.

3.7.4 Sampling Devices

Bacon Bomb Sampler

The bacon bomb sampler (Figure 9, Appendix B) is designed to collect material from various levels within a storage tank. It consists of a cylindrical body, usually made of chrome-plated brass and bronze with an internal tapered plunger that acts as a valve to admit the sample. A line attached to the top of the plunger opens and closes the valve. A line is attached to the removable top cover which has a locking mechanism to keep the plunger closed after sampling.

1. Attach the sample line and the plunger line to the sampler.

2. Measure and then mark the sampling line at the desired depth.

3. Gradually lower the bacon bomb sampler by the sample line until the desired level is reached.

4. When the desired level is reached, pull up on the plunger line and allow the sampler to fill before releasing the plunger line to seal off the sampler.

5. Retrieve the sampler by the sample line. Be careful not to pull up on the plunger line and thereby prevent accidental opening of the bottom valve.

6. Rinse or wipe off the exterior of the sampler body.

7. Position the sampler over the sample container and release its contents by pulling up on the plunger line.

8. Cap the sample container tightly and place prelabeled sample container in a carrier.

9. Replace the bung or place plastic over the tank.

10. Log all samples in the site logbook and on field data sheets and label all samples.

11. Package samples and complete necessary paperwork.

12. Transport sample to decontamination zone to prepare it for transport to the analytical laboratory.

Sludge Judge

A sludge judge (Figure 10, Appendix B) is used for obtaining an accurate reading of solids which can settle, in any liquid, to any depth. The sampler consists of 3/4-inch plastic pipe in 5-foot sections, marked at 1-foot increments, with screw-style fittings. The top section includes a nylon line for raising the sampler.

1. Lower the sludge judge to the bottom of the tank.

2. When the bottom has been reached, and the pipe has filled to surface level, tug slightly on the rope as you begin to raise the unit. This will seat the check valve, trapping the column of material.

3. When the unit has been raised clear of the tank liquid, the amount of sludge in the sample can be read using the 1-foot increments marked on the pipe sections.

4. By touching the pin extending from the bottom section against a hard surface, the material is released from the unit.

5. Cap the sample container tightly and place prelabeled sample container in a carrier.

6. Replace the bung or place plastic over the tank.

7. Log all samples in the site logbook and on field data sheets and label all samples.

8. Package samples and complete necessary paperwork.

9. Transport sample to decontamination zone to prepare it for transport to the analytical laboratory.

Subsurface Grab Sampler

Subsurface grab samplers (Figure 11, Appendix B) are designed to collect samples of liquids at various depths. The sampler is usually constructed of aluminum or stainless steel tubing with a polypropylene or Teflon head that attaches to a 1-liter sample container.

1. Screw the sample bottle onto the sampling head.

2. Lower the sampler to the desired depth.

3. Pull the ring at the top which opens the spring-loaded plunger in the head assembly.

4. When the bottle is full, release the ring, lift sampler, and remove sample bottle.

5. Cap the sample container tightly and place prelabeled sample container in a carrier.

6. Replace the bung or place plastic over the tank.

7. Log all samples in the site logbook and on field data sheets and label all samples.

8. Package samples and complete necessary paperwork.

9. Transport sample to decontamination zone to prepare it for transport to the analytical laboratory.

Glass Thief

The most widely used implement for sampling is a glass tube commonly referred to as a glass thief (Figure 7, Appendix B). This tool is simple, cost effective, quick, and collects a sample without having to decontaminate. Glass thieves are typically 6mm to 16mm I.D. and 48 inches long.

1. Remove cover from sample container.

2. Insert glass tubing almost to the bottom of the

tank or until a solid layer is encountered. About 1 foot of tubing should extend above the tank.

3. Allow the waste in the tank to reach its natural level in the tube.

4. Cap the top of the sampling tube with a tapered stopper or thumb, ensuring liquid does not come into contact with stopper.

5. Carefully remove the capped tube from the tank and insert the uncapped end in the sample container. Do not spill liquid on the outside of the sample container.

6. Release stopper and allow the glass thief to drain until the container is approximately 2/3 full.

7. Remove tube from the sample container, break it into pieces and place the pieces in the tank.

8. Cap the sample container tightly and place prelabeled sample container in a carrier.

9. Replace the bung or place plastic over the tank.

10. Log all samples in the site logbook and on field data sheets and label all samples.

11. Package samples and complete necessary paperwork.

12. Transport sample to decontamination zone to prepare it for transport to the analytical laboratory.

In many instances a tank containing waste material will have a sludge layer on the bottom. Slow insertion of the sample tube down into this layer and then a gradual withdrawal will allow the sludge to act as a bottom plug to maintain the fluid in the tube. The plug can be gently removed and placed into the sample container by the use of a stainless steel lab spoon.

Bailer

The positive-displacement volatile sampling bailer (manufactured by GPI or equivalent) (Figure 12, Appendix B) is perhaps the most appropriate for collecting water samples for volatile analysis. Other bailer types (messenger, bottom fill, etc.) are less desirable, but may be mandated by cost and site conditions. Generally, bailers can provide an acceptable sample, providing that the sampling personnel use extra care in the collection process.

1. Make sure clean plastic sheeting surrounds the tank.

2. Attach a line to the bailer.

3. Lower the bailer slowly and gently into the tank so as not to splash the bailer into the tank contents.

4. Allow the bailer to fill completely and retrieve the bailer from the tank.

5. Begin slowly pouring from the bailer.

6. Cap the sample container tightly and place prelabeled sample container in a carrier.

7. Replace the bung or place plastic over the tank.

8. Log all samples in the site logbook and on field data sheets and label all samples.

9. Package samples and complete necessary paperwork.

10. Transport sample to decontamination zone to prepare it for transport to an analytical laboratory.

COLIWASA

Some equipment is designed to collect a sample from the full depth of a tank and maintain it in the transfer tube until delivery to the sample bottle. These designs include primarily the Composite Liquid Waste Sampler (COLIWASA) (Figure 8, Appendix B) and modifications thereof. The COLIWASA is a much cited sampler designed to permit representative sampling of multiphase wastes from tanks and other containerized wastes. One configuration consists of a 152 cm by 4 cm I.D. section of tubing with a neoprene stopper at one end attached by a rod running the length of the tube to a locking mechanism at the other end. Manipulation of the locking mechanism opens and closes the sampler by raising and lowering the neoprene stopper.

The major drawbacks associated with using a COLIWASA concern decontamination and costs. The sampler is difficult if not impossible to decontaminate in the field and its high cost in relation to alternative procedures (glass tubes) make it an impractical throwaway item. It still has applications, however, especially in instances where a true representation of a multiphase waste is absolutely necessary.

1. Put the sampler in the open position by placing the stopper rod handle in the T-position and pushing the rod down until the handle sits against the sampler's locking block.

2. Slowly lower the sampler into the liquid waste. Lower the sampler at a rate that permits the levels of the liquid inside and outside the sampler tube to be about the same. If the level of the liquid in the sample tube is lower than that outside the sampler, the sampling rate is too fast and will result in a non-representative sample.

3. When the sampler stopper hits the bottom of the waste container, push the sampler tube downward against the stopper to close the sampler. Lock the sampler in the closed position by turning the T-handle until it is upright and one end rests tightly on the locking block.

4. Slowly withdraw the sample from the waste container with one hand while wiping the sampler tube with a disposable cloth or rag with the other hand.

5. Carefully discharge the sample into a suitable sample container by slowly pulling the lower end of the T-handle away from the locking block while the lower end of the sampler is positioned in a sample container.

6. Cap the sample container tightly and place prelabeled sample container in a carrier.

7. Replace the bung or place plastic over the tank.

8. Log all samples in the site logbook and on field data sheets and label all samples.

9. Package samples and complete necessary paperwork.

10. Transport sample to decontamination zone to prepare it for transport to the analytical laboratory.

3.8 CALCULATIONS

Refer to Appendix C for calculations to determine tank volumes.

3.9 QUALITY ASSURANCE/ QUALITY CONTROL

There are no specific quality assurance activities which apply to the implementation of these procedures. However, the following general QA procedures apply:

- All data must be documented on field data sheets or within site logbooks.
- All instrumentation must be operated in accordance with operating instructions as supplied by the manufacturer, unless otherwise specified in the work plan. Equipment checkout and calibration activities must occur prior to sampling/operation and they must be documented.

3.10 DATA VALIDATION

This section is not applicable to this SOP.

3.11 HEALTH AND SAFETY

When working with potentially hazardous materials, follow U.S. EPA, OSHA, and specific health and safety procedures. More specifically, the hazards associated with tank sampling may cause bodily injury, illness, or death to the worker. Failure to recognize potential hazards of waste containers is the cause of most accidents. It should be assumed that the most unfavorable conditions exist, and that the danger of explosion and poisoning will be present. Hazards specific to tank sampling are:

- Hazardous atmospheres can be flammable, toxic, asphyxiating, or corrosive.
- If activating electrical or mechanical equipment would cause injury, each piece of equipment should be manually isolated

APPENDIX D

CLP GUIDELINES

ROUTINE ANALYTICAL SERVICES

(RAS)

Contract Laboratory Program

USEPA Sample Management Office

Low/Medium Concentration Inorganic RAS

- Target Analyte List
  - Total Metals (Unfiltered)
  - Dissolved Metals (Field Filtered)
  - Cyanide
- AA or ICP Methods
- 35-day Data Turnaround

High Concentration Inorganic RAS

- Target Analyte List
  - Total Metals
  - Cyanide
- Hydride ICP
- Lab Screens for Concentration
- 35-Day Data Turnaround

Laboratory Quality Control (QC)
High Concentration Inorganic RAS

- Matrix Spike
- Duplicate
- Lab Control Sample
- Double Volume Field Sample for Waters
- QC Needed for Each SDG

CLP Samples

A Sample is *All* Volume:

1) Of One Matrix
2) From One Station Location
3) For One Analytical Program
4) For One Laboratory

Each Sample is Assigned a Unique Sample Number

RAS Requests - Required Information

- Site Name
- Location: City and State
- Site/Spill Code
- Type of Activity
- Sampling Organization, Contact, and Phone Number
- Sampling and Shipping Dates
- Number of Samples By Concentration and Matrix
- Parameters Required
- Known or Suspected Hazards

Sample Documentation

- Creates a Legal "Paper Trail" for Enforcement
- Data Base on Sample Level
- CLP Paperwork and Tracking Systems Audited
- Case Numbers, SAS Numbers Reflect Different Contracts
- Contract Compliance Screening
- Late Data Tracking
- Billing and Accounting

Potential Problems with Sample Shipment and Analysis

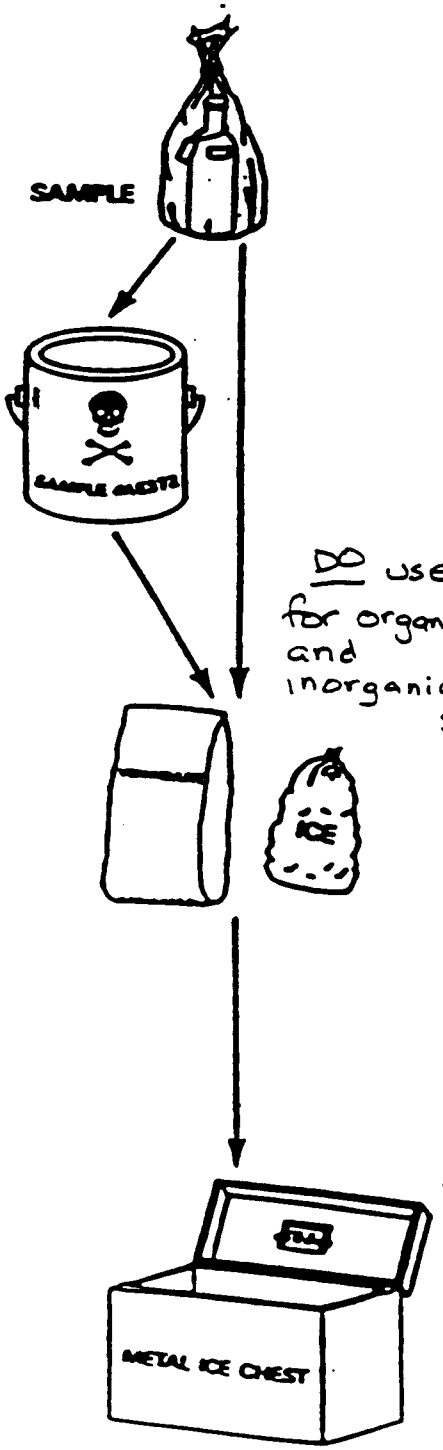
- Incorrect or Incomplete Paperwork
- Laboratory Receipt of Incorrect Samples
- Insufficient Volume for Analysis Requested
- Broken or Leaking Samples
- Matrices other than Water or Soil (i.e., Rocks, Leaves, Sticks, Oil, Etc.)
- Non-Homogeneous/Multi-Phase Water or Soil Samples
- Analytical Problems with Samples
- Laboratory Accidents Involving Samples

If Any of These Problems Are Encountered, Contact SMO Immediately

RAS Summary

- Standardized Analyses for Organics and Inorganics
- Low/Medium Concentration Waters and Soils
- High Concentration Multi-Phase Samples
- One Week Leadtime
- Projects Designated by a Case Number, Example: Case No. 17000

SAMPLE PACKAGING SUMMARY



- ENCLOSE ALL SAMPLE CONTAINERS IN CLEAR PLASTIC BAGS.
- PACK ALL MEDIUM AND HIGH LEVEL WATER AND SOIL SAMPLES IN METAL PAINT CANS.
- LABEL PAINT CANS WITH SAMPLE NUMBER OF SAMPLE CONTAINED INSIDE.
- SURROUND CONTENTS OF CAN WITH NON-COMBUSTIBLE, ABSORBENT PACKING MATERIAL.
- USING FREEZER PACKAGES OR ICE SEALED IN PLASTIC BAGS, COOL ORGANIC LOW OR MEDIUM SAMPLES AND INORGANIC SAMPLES TO BE ANALYZED FOR CYANIDE TO 4°C.
- ICE IS NOT REQUIRED IN SHIPPING LOW LEVEL SOIL SAMPLES, BUT MAY BE UTILIZED AT THE DISCRETION OF THE SAMPLER.
- DO NOT COOL DIOXIN, INORGANIC LOW LEVEL WATER, INORGANIC MEDIUM/HIGH LEVEL WATER OR SOIL, OR ORGANIC HIGH LEVEL WATER OR SOIL SAMPLES.
- PACK SEALED PAINT CANS OR PLASTIC-ENCLOSED SAMPLE BOTTLES IN SHIPMENT CONTAINER.
- USE A METAL ICE CHEST FOR SHIPMENT (DO NOT USE CARDBOARD OR STYROFOAM CONTAINERS TO SHIP SAMPLES).
- SURROUND CONTENTS WITH NON-COMBUSTIBLE, ABSORBENT PACKING MATERIAL (DO NOT USE EARTH OR ICE PACKING MATERIALS).
- TAPE PAPERWORK IN PLASTIC BAGS UNDER COOLER LID.
- CLOSE COOLER AND SEAL WITH CUSTODY SEALS.

EPA Contract Laboratory Program Sample Management Office
PO Box 818 Alexandria, VA 22313
703-557-2490 FTS 557-2490

& Chain of Custody Record
(For Organic CLP Analysis)

(if applicable) N/A 17892

Project Code	Account Code	2. Region No.	Sampling Co.	4. Date Shipped	Carrier
6-85231	SF-05	VI	VIAR + CO.	11/13/91	FEDERAL EXPRESS

Regional Information: —

Non-Superfund Program: —

Site Name: DIOXINS 'R' US

City, State: DALLAS, TX

Site Spill ID: 77

Sampler (Name): KEVIN K. CONNELL

Sampler Signature: K.K. Connell

Airbill Number: 3758921237

5. Ship To:
NATEX / GULF SOUTH ENVIRON. LAB
6801 PRESS DR., EAST BLDG.
NEW ORLEANS, LA 70126
ATTN: KAREN BRANDT

3. Type of Activity
Lead: SF, PRP, ST, FED
Pre-Remedial: PA, SSI, LSI
Remedial: RIFS [X], RD, RA, O&M, NPLD
Removal: CLEM, REMA, REM, OIL, UST

6. Preservative (Enter in Column D)
1. HCl
2. HNO_3
3. $NaHSO_4$
4. H_2SO_4
5. Other (SAS) (Specify)
6. Ice only
N. Not preserved

7. Sample Description (Enter in Column A)
1. Surface Water
2. Ground Water
3. Leachate
4. Rinsate
5. Soil/Sediment
6. Oil (SAS)
7. Waste (SAS)
8. Other (SAS) (Specify)

CLP Sample Numbers (from labels)	A Enter # from Box 7	B Conc. Low Med High	C Sample Type: Comp./Grab	D Preservative from Box 6	E RAS Analysis VOA	BNA	Pest/PCB	High ARO/TOX	F Regional Specific Tracking Number or Tag Numbers	G Station Location Number	H Mo/Day/Year/Time Sample Collection	I Sampler Initials	J Corresp. CLP Inorg. Samp. No.	K Designated Field QC
FL 140	5	L	G	N			X		6-14738	SS-01	11/13/91, 9:15	KC	MFL 140	
FL 141	5	L	G	N			X		6-14739	SS-02	11/13/91, 9:30	KC	MFL 141	
FL 142	1	L	G	N			X		6-14740	SW-01	11/13/91, 11:00	KC	MFL 142	
FL 142	1	L	G	N			X		6-14741	SW-01	11/13/91, 11:00	KC	MFL 142	
FL 142	1	L	G	N			X		6-14742	SW-01	11/13/91, 11:00	KC	MFL 142	
FL 143	2	L	G	N			X		6-14743	GW-01	11/13/91, 1:45	KC	MFL 143	
FL 144	1	L	G	N	X				6-14744			KC	—	TRIP BLANK

Shipment for Case complete? (Y/N)

Page 1 of 1

Sample used for a spike and/or duplicate: FL 140; FL 142

Additional Sampler Signatures

Chain of Custody Seal Number: 789462

CHAIN OF CUSTODY RECORD

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
K.K. Connell	11/13/91 4:20				
Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
~~Received by~~ (Signature)	Date / Time	Received for Laboratory by: (Signature)	Date / Time	Remarks Is custody seal intact? Y/N/none	

Split Samples [ ] Accepted [ ] Declined (Signature)

This form replaces both the Individual Traffic Report and EPA Chain of Custody Record. If the sampling team elects to use an alternative chain-of-custody form, cross out the bottom portion of this record and indicate that chain-of-custody information is recorded on an alternative form.

Water Samples	Required Volume	Container Type
Extractable Analysis (Low Level)	1 Gallon	1 X 4-Liter Amber Glass Bottle OR 2 X 80-oz. Amber Glass Bottle OR 4 X 1-Liter Amber Glass Bottles
Extractable Analysis (Medium Level*)	1 Gallon	32-oz. Wide-Mouth Glass Jars
Volatile Analysis (Low or Medium Level*)	80 ml	2 X 40-ml. Glass Vials

Soil/Sediment Samples	Required Volume	Container Type
Extractable Analysis (Low or Medium Level*)	6 oz	1 X 8-oz. Wide-Mouth Glass Jar OR
	240 ml	2 X 4-oz. Wide-Mouth Glass Jars
Volatile Analysis (Low or Medium Level*)		2 X 120 ml Wide-Mouth Glass Vials

†Soil VOA Vials under study, subject to change, check to ensure proper sealing

*All Medium and High Level Samples to be Sealed in Metal Can for Shipment

HIGH CONCENTRATION SAMPLE COLLECTION REQUIREMENTS

Liquid or Solid Samples	Required Volume	Container Type
Extractable and Volatile Analysis	6 oz.	1 X 8-oz. Wide-Mouth Glass Jar

1. **Organic Sample Collection Requirements**
   - Please indicate sample to spike and/or duplicate.
   - Ship medium and high concentration samples in paint cans.
   - Aqueous samples require one triple-volume sample per twenty for Matrix Spike/Matrix Spike Duplicate.
   - Oily samples must be analyzed under the Special Analytical Services (SAS) program.
   - Confirmatory analysis and Special Analytical Services (SAS) parameters may require extra volume: for SAS consult specified SAS methods for requirements.
   - Additional sample volume not required for method OLC01.

2. **Cooler and Sample Documentation**
   - Complete all sections of the Traffic Report/Chain of Custody Form - Press firmly with a ball point pen to ensure that carbon copies are legible. Check the information and correct any errors.
   - Please remember to complete the Chain of Custody information on the form.
   - Seal the two sets of laboratory Traffic Report/Chain of Custody form copies in a plastic bag. Include a return address for the cooler. Tape bag under cooler lid.
   - Overlap the lid and bottle and bottle of each sample container with custody seals.
   - Seal each container in a plastic bag.
   - Pack medium and high concentration samples in metal cans.
   - Cool low waters to 4° C. Cooling of low soils is optional. Do not cool medium or high concentration waters and soils.
   - Separate and surround cooler contents with vermiculite or equivalent packaging.
   - Seal the cooler, overlapping the lid and body with custody seals.
   - FAX SMO a copy of the Traffic Report/Chain of Custody Form as soon as possible. Send SMO the pink copy of the Traffic Report within 5 days.
   - In column E RAS analysis indicate number of sample bottles sent for analysis.

3. **Sample Shipment Reporting**
   - PHONE IN ALL SHIPMENTS IMMEDIATELY TO SMO (or to RSCC, if instructed)
     Required information:
     - Case (and/or SAS) Number
     - Date shipped
     - Number of samples by concentration and matrix
     - Carrier and airbill number
     - Next planned shipment

     Leave your name and a number where you can be reached.
   - Information for SATURDAY DELIVERIES must be phoned in by 3:00 PM (Eastern) the preceding FRIDAY.
   - Report any delays or changes of scope (i.e., changes in number of samples to be collected, matrix changes, etc.)
   - CALL IF YOU HAVE ANY QUESTIONS

     USEPA Contract Laboratory Program
     Sample Management Office
     P.O. Box 818
     Alexandria, VA 22313
     Phone: (703) 557-2490
     (703) 684-5678
     FAX: (703) 683-0378

EPA

P.O. Box 818 Alexandria VA 22313
703 557 2490 FTS 557 2490

& Chain of Custody Record

(For Inorganic CLP Analysis)

1 Sample Description (Enter in Column A)
1 Surface Water
2 Ground Water
3 Leachate
4 Rinsate
5 Soil/Sediment
6 Oil (SAS)
7 Waste (SAS)
8 Other (SAS)
(Specify)

2 Preservative (Enter in Column D)
1 HCl
2 HNO3
3 NaOH
4 H_2SO_4
5 $K_2CR_2O_7$
6 Ice only
7 Other (SAS)
(Specify)
N Not preserved

3 Region No | Sampling Co

Sampler (Name)

Sampler Signature

4 Type of Activity

	Lead	Pre Remedial	Remedial	Removal
SF			RIFS	CLEM
PRP		PA	RD	REMA
ST		SSI	RA	REM
FED		LSI	O&M	OIL
			NPLD	UST

5 Date Shipped | Carrier

Airbill Number

6. Ship To

7 Date Received | Received by

Laboratory Contract Number | Unit Price

8. Transfer to | Date Received

Received by

Contract Number | Price

CLP Sample Numbers (from labels)	A Enter # from Box 1	B Conc Low Med High	C Sample Type Comp / Grab	D Preservative from Box 6	E RAS Analysis: Metals Total	Metals Dissolved	Cyanide	Low Conc Nitrate/ Nitrite	Low Conc Fluoride	High pH	High Conductivity	F Regional Specific Tracking Number or Tag Numbers	G Station Location Number	H Mo/Day/ Year/Time Sample Collection	I Sampler Initials	J Corresp. CLP Org. Samp. No	K Sample Condition on Receipt	L High Conc. Phases (Check below): Solids	Water - MS Lig	Non Water - MS Lig

Shipment for Case Complete? (Y/N)

Page 1 of

Sample used for a spike and/or duplicate

Additional Sampler Signatures

Chain of Custody Seal Number

CHAIN OF CUSTODY RECORD

Relinquished by (Signature)	Date / Time	Received by (Signature)	Relinquished by (Signature)	Date / Time	Received by (Signature)
Relinquished by (Signature)	Date / Time	Received by (Signature)	Relinquished by (Signature)	Date / Time	Received by (Signature)
Received by (Signature)	Date / Time	Received for Laboratory by (Signature)	Date / Time	Remarks	Is custody seal intact? Y/N/none

Split Samples [ ] Accepted (Signature)

[ ] Declined

EPA Form 9110 1 (Rev. 5-91) Replaces EPA Form (2075-6) previous edition which may be used

DISTRIBUTION

Green - Region Pink - SMO Copy White - Lab Copy Yellow - Lab Copy for Return to SMO

EXHIBIT C

TARGET COMPOUND LIST (TCL) AND CONTRACT REQUIRED QUANTITATION LIMITS (CRQL)

LOW/MEDIUM CONC.

RAS ORGANIC

NOTE: The values in these tables are quantitation limits, not absolute detection limits. The amount of material necessary to produce a detector response that can be identified and reliably quantified is greater than that needed to simply be detected above the background noise. The quantitation limits in these tables are set at the concentrations in the sample equivalent to the concentration of the lowest calibration standard analyzed for each analyte.

Specific quantitation limits are highly matrix dependent. The quantitation limits listed herein are provided for guidance and may not always be achievable.

The CRQL values listed on the following pages are based on the analysis of samples according the specifications given in Exhibit D. For each fraction and matrix, a brief synopsis of the sampling handling and analysis steps is given, along with an example calculation for the CRQL value. All CRQL values are rounded to two significant figures. For soil samples, the moisture content of the samples is not considered in these example calculations.

TARGET COMPOUND LIST (TCL) AND CONTRACT REQUIRED QUANTITATION LIMITS (CRQL)

Pesticides/Aroclors	CAS Number	Quantitation Limits* Water ug/L	Soil ug/Kg	On Column (pg)
98. alpha-BHC	319-84-6	0.05	1.7	5
99. beta-BHC	319-85-7	0.05	1.7	5
100. delta-BHC	319-86-8	0.05	1.7	5
101. gamma-BHC (Lindane)	58-89-9	0.05	1.7	5
102. Heptachlor	76-44-8	0.05	1.7	5
103. Aldrin	309-00-2	0.05	1.7	5
104. Heptachlor epoxide	1024-57-3	0.05	1.7	5
105. Endosulfan I	959-98-8	0.05	1.7	5
106. Dieldrin	60-57-1	0.10	3.3	10
107. 4,4'-DDE	72-55-9	0.10	3.3	10
108. Endrin	72-20-8	0.10	3.3	10
109. Endosulfan II	33213-65-9	0.10	3.3	10
110. 4,4'-DDD	72-54-8	0.10	3.3	10
111. Endosulfan sulfate	1031-07-8	0.10	3.3	10
112. 4,4'-DDT	50-29-3	0.10	3.3	10
113. Methoxychlor	72-43-5	0.50	17.0	50
114. Endrin ketone	53494-70-5	0.10	3.3	10
115. Endrin aldehyde	7421-36-3	0.10	3.3	10
116. alpha-Chlordane	5103-71-9	0.05	1.7	5
117. gamma-Chlordane	5103-74-2	0.05	1.7	5
118. Toxaphene	8001-35-2	5.0	170.0	500
119. Aroclor-1016	12674-11-2	1.0	33.0	100
120. Aroclor-1221	11104-28-2	1.0	33.0	100
121. Aroclor-1232	11141-16-5	2.0	67.0	200
122. Aroclor-1242	53469-21-9	1.0	33.0	100
123. Aroclor-1248	12672-29-6	1.0	33.0	100
124. Aroclor-1254	11097-69-1	1.0	33.0	100
125. Aroclor-1260	11096-82-5	1.0	33.0	100

* Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment, calculated on dry weight basis as required by the contract, will be higher.

There is no differentiation between the preparation of low and medium soil samples in this method for the analysis of Pesticides/Aroclors.

APPENDIX E

SITE EVALUATION CHECKLIST

SITE RECONNAISSANCE CHECKLIST
GENERAL SITE INFORMATION WORKSHEET

I. SITE INSPECTION INFORMATION

1. ____ Date and time of the inspection: ___/___/___ at ___:___ a.m/p.m

2. ____ WESTON personnel performing the inspection:
   a._____
   b._____
   c._____

3. ____ Names of site owner or representatives present
   a._____
   b._____
   c._____

4. ____ Names of regulatory officials present:
   a._____
   b._____
   c._____

5. ____ Weather conditions during inspection:
   a. Temperature: _____ degrees F
   b. Cloud Cover: _____ percent
   c. Rain/snow: _____ amount

II. GENERAL SITE INFORMATION

1. ____ Official site name / CERCLIS ID: _____ (TXD_____)
2. ____ Accurate street address: _____
3. ____ City and State: _____

4. ____ List current owner(s) name(s) and address(es):

5. ____ List past site owners and addressess, if possible:

5. ____ Indicate ownership type ("C" for current, "P" for past)
   a. ____ Private
   b. ____ Municipal
   c. ____ County
   d. ____ State
   e. ____ Unknown
   e. ____ Federal
   f. ____ DOD
   g. ____ DOE
   h. ____ Indian
   i. ____ Other (describe): _____

B. ____ Verify site location on a topo map, indicating the reason for any discrepancies below:

III. SITE FEATURES

1. ____ Draw a sketch map of the site to show the location of important site features

2. ____ Describe site access features:
   a. Locations where the site can be accessed: _____
   b. Major roads leading to site: _____
   c. On-site roads / paths and their condition: _____
   d. Location/condition of barricades impeding site access: _____

3. ____ List current/historic site occupants and landuse:
   a. _____
   b. _____
   c. _____
   d. _____

4. ____ Indicate the nature of the site occupant(s) (put corresponding letter from above beside type below

a. ____ Lumber or wood products	l. ____ Retail
b. ____ Inorganic chemicals	m. ____ Recycling
c. ____ Plastics or rubber products	n. ____ Junk/salvage yard
d. ____ Paints or varnishes	o. ____ Municipal landfill
e. ____ Industrial organic chemicals	p. ____ DOD
f. ____ Agricultural chemicals	q. ____ DOE
g. ____ Misc. chemical products	r. ____ DOI
h. ____ Fabricated structural metal products	s. ____ Other federal facility: _____
i. ____ Electronic equipment	t. ____ RCRA TSD site: _____
j. ____ Other manufacturing: _____	u. ____ RCRA generator: _____
k. ____ Mining and other exploration: _____	v. ____ Other RCRA: _____
	x. ____ Other: _____

5. ____ Status: a. ____ Active b. ____ Inactive or left site

6. ____ Describe buildings or other structures (occupant, size, location, use)
   a. _____
   b. _____
   c. _____
   d. _____
   e. _____

7. ____ Locate and describe the following:
   a. ____ Municipal water supply hook ups, if any _____
   b. ____ Storm drain Inlets or discharge points _____
   c. ____ Sanitary sewers _____
   d. ____ Parking lots and other impervious surfaces _____
   e. ____ Water wells _____
   f. ____ Oil and gas wells: _____
   g. ____ Mining activities onsite: _____
   h. ____ Rail spur locations (usage): _____
   i. ____ Pipelines (owner/contents): _____
   j. ____ Other easements: _____

IV. NATURAL SITE FEATURES

1. ____ Describe regional and site topography
2. ____ Determine the site surface gradient / slope
3. ____ Describe site and adjacent property vegetation
4. ____ Describe site surface soils (texture, color, structure)

5. ____ Describe site and local surface geological features (lithology, structures, grain size)

6. ____ Locate and map nearby surface water bodies surface:
   a. Determine the dimensions and profile of each surface water body

   b. Describe flow rate and direction of flow, if any

   c. Indicate the type surface water usage (fisheries, water intakes)

7. ____ Locate and map any springs, seeps, ponded areas or wetlands

8. ____ Locate and map any drainage swales or ditches onsite

9. ____ Determine the direction and destination of site runoff

10. ____ List other potentially sensitive environments
    a. _____
    b. _____
    c. _____

V. OTHER NOTABLE SITE FEATURES

1. ____ Describe any other notable site features below:

VI. SITE OPERATIONAL HISTORY

1. ____ Describe the exact types and quantities of wastes stored and generated (what/when):
   a. _____
   b. _____
   c. _____
   d. _____
   e. _____
   f. _____

2. ____ Determine the locations of historic waste disposal practices onsite (check as source area below):

3. ____ Map and describe historic buildings, storage areas or process areas no longer obvious onsite:

4. ____ Determine the current/historical number of occupants or workers onsite daily _____

5. ____ Describe in detail the current/historical processes used onsite:

6. ____ List site environmental related permits (RCRA, TACB, TWC, TRRC, TDH, etc.)
   a. _____
   b. _____
   c. _____
   d. _____

7. ____ Get copies of any manifests or other records available

8. Describe other relevant facts concerning site operations:

A. Check the potential waste sources below which are found onsite:

1. ____ Dry wells or injection wells
2. ____ Ponds, lagoons or other surface impoundment
3. ____ Landfills
4. ____ Land treatment or land farming areas
5. ____ Areas of contaminated soil
6. ____ Storage tanks or other nondrum containers
7. ____ Drums or drum-like containers
8. ____ Incineration areas or burn pits
9. ____ Piles (Chemical, scrap metals, tailings, etc.)
10. ____ Ventilation systems
11. ____ Hydraulic lifts
12. ____ Pits or sumps
13. ____ Transformers
14. ____ Contaminated sediments or surface water with unidentified source
15. ____ Contaminated groundwater with unidentified source
16. ____ Other source type (describe:_____)
17. ____ No sources identified

SITE RECONNAISSANCE CHECKLIST
WASTE SOURCE DESCRIPTION WORKSHEET

(Complete one sheet for each source area)

1. ____ Assign waste source a name for identification: _____
2. ____ Status of source area (closed, inactive, active) _____
3. ____ Locate the source area on a map and describe location: _____
4. ____ Measure the dimensions of the source area: _____
5. ____ Determine the length of time that the source area contained waste: _____
6. ____ Describe the method of source containment and degree of maintenance: _____
7. ____ Describe the method of secondary containment and maintenance:
8. ____ Indicate the current and historical contents of source area:
   - a. ____ Metals
   - b. ____ Inorganics
   - c. ____ Organics
   - d. ____ Radioactive waste
   - e. ____ Pesticides/herbicides
   - f. ____ Oily waste
   - g. ____ Mining waste
   - h. ____ Explosives
   - i. ____ Paints/pigments/dyes
   - j. ____ Solvents
   - k. ____ Laboratory/hospital waste
   - l. ____ Construction/demolition waste
   - m. ____ Acids/bases
   - n. ____ Municipal/residential type waste
   - l. ____ Other (describe) _____
9. ____ Describe the physical state of the waste (check one)
   - a. ____ Solid
   - b. ____ Powder
   - c. ____ Liquid
   - d. ____ Sludge
   - e. ____ Gas
10. ____ Determine the location of waste generation:
    - a. ____ onsite
    - b. ____ offsite (generator): _____
11. ____ Indicate who authorized waste deposition:
    - a. ____ Present owner
    - b. ____ Former owner
    - c. ____ Unauthorized
    - d. ____ Unknown
12. ____ Assess the accessibility of the source area to the public:
    - a. ____ Accessable
    - b. ____ Nonaccessable (why): _____
13. ____ Current and historical high level of containment
14. ____ Method of secondary containment and degree of maintenance
15. ____ Indicate if there is visual evidence of a release
    - a. ____ Discharges or waste streams (Indicate receiving body): _____
    - b. ____ Leachate outbreak
    - c. ____ Spill or leak
    - d. ____ Other type of release (describe): _____
16. ____ Indicate if there is visual evidence of contamination around source
    - a. ____ Stained/contaminated soil (area): _____
    - b. ____ No evidence of
17. ____ Describe cover over the source area
    - a. ____ Engineered cap
    - b. ____ Buried (w/soil, asphalt, etc.)
    - c. ____ Other (Roof, tarp, etc.)
18. ____ Functioning collection or venting system (describe in detail)
19. ____ Evidence of biogas release (odors, vapors, FID response)
20. ____ Describe Vegetation around source area:
    - a. Type and degree of vegetation: _____
    - b. Condition of vegetation (stressed/unaffected): _____

VII. OFF-SITE SURVEY

1. ____ Describe and locate on map adjacent and nearby sites of interest:
   a. _____
   b. _____
   c. _____

2. ____ Map location of public facilities (schools, day care facilities, parks, etc.)
   a. _____
   b. _____
   c. _____

3. ____ Determine the location and number of residences within a 1/2 mile radius of the site.

4. ____ Determine the population of workers, schoolchildren, etc in areas near the site

5. ____ List alternative source sites within a four mile radius:
   a. Automobile service stations
      1. _____
      2. _____
   b. Dry cleaners
      1. _____
      2. _____
   c. Manufacturing/industrial sites
      1. _____
      2. _____
   d. Rail loading areas
      1. _____
   e. Landfills
      1. _____
   f. Other sites
      1. _____

6. ____ Locate and describe surface water bodies as follows:
   a. Distance to probable point of entry of a waste from the site _____
   b. Flow rate and direction of flow _____
   c. Storm drains discharging into the surface water body _____
   d. Potential targets along the surface water _____
   e. Branching in surface water flow path and effect on target _____
   f. Tidal influence effect on flow _____
   g. Tributaries with alternative source sites _____
   h. Drinking water intakes _____
   i. Fishing or other recreational use recreation _____

7. ____ Locate and describe water wells in the distance limit, as possible:
   a. Location of well and distance from site _____
   b. Well owner and population potentially served _____
   c. Well usage and completion information _____